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SYSTEMATIC INVESTIGATIONS IN PHANEROGAMS, FERNS, AND DIATOMS

ADVERTISEMENT.

The United States National Herbarium, which was founded by the Smithsonian Institution, was transferred in the year 1868 to the Department of Agriculture, and continued to be maintained by that Department until July 1, 1896, when it was returned to the official custody of the Smithsonian Institution. The Department of Agriculture, however, continued to publish the series of botanical reports entitled "Contributions from the United States National Herbarium," begun in the year 1890, until, on July 1, 1902, the National Museum, in pursuance of an act of Congress, assumed responsibility for the publication. The first seven volumes of the series were issued by the Department of Agriculture.

RICHARD RATHBUN,
Assistant Secretary, Smithsonian Institution,
in charge of the United States National Museum.

SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM

CONTRIBUTIONS

FROM THE

UNITED STATES NATIONAL HERBARIUM

VOLUME X

SYSTEMATIC INVESTIGATIONS IN PHANEROGAMS, FERNS, AND DIATOMS

NORTH AMERICAN SPECIES OF FESTUCA; GENUS PTELEA IN THE WESTERN AND SOUTHWESTERN UNITED STATES AND MEXICO; MEXICAN AND CENTRAL AMERICAN PLANTS; LEGUMINOSAE OF PORTO RICO; DIATOMS OF THE ALBATROSS VOYAGES; CYPERACEAE OF COSTA RICA; TROPICAL AMERICAN FERNS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1906–1908

NOTE.

The seven parts of Volume X of the Contributions were issued as follows:

Part 1, pages 1 to 48, March 30, 1906.
Part 2, pages 49 to 78, July 16, 1906.
Part 3, pages 79 to 132, December 5, 1906.
Part 4, pages 133 to 220, June 10, 1907.
Part 5, pages 221 to 442, July 11, 1907.
Part 6, pages 443 to 472, January 21, 1908.
Part 7, pages 473 to 508, March 30, 1908.

PREFACE.

The present volume of the Contributions from the United States National Herbarium consists of seven papers.

The first paper, by Charles V. Piper, "North American Species of Festuca," was prepared in the Office of the Agrostologist, Department of Agriculture, but in view of the fact that it was of a strictly systematic—not agricultural—character, it was offered to the National Museum for publication and was accepted. The author of the manuscript regrets that it was not possible to consult all the type specimens of the American species, several of which are in European herbaria, but he considers it preferable to offer his work for publication now rather than to delay it indefinitely.

The second paper, entitled "The Genus Ptelea in the Western and Southwestern United States and Mexico," by Dr. Edward L. Greene, Associate in Botany, United States National Museum, is the result of an exhaustive study of the western species of Ptelea. Doctor Greene finds that this genus, instead of being composed of only a few species, is a very large one, and describes 59 species, of which 55 are new. His work is based chiefly on the large series of specimens in the National Herbarium, in his own collection now deposited here, and in Capt. John Donnell Smith's, eventually to come here, together with the collections of the late C. C. Parry and that of the California Academy of Sciences. The types are chiefly in the National Herbarium, and unless otherwise indicated are to be understood as belonging here.

The third paper consists of the fifth number of "Studies of Mexican and Central American Plants," by Dr. J. N. Rose, Associate Curator, Division of Plants, United States National Museum. Doctor Rose has made five journeys to Mexico, each of which has resulted in the acquisition of a valuable collection for the National Herbarium and in a published report. Each of these reports, like the accompanying one, covers only fragmentary portions of his whole work. All, however, are devoted to the elucidation of the same general subject, the flora of central Mexico, and together they form a highly valuable series of contributions to our botanical knowledge of that region.

The fourth paper is "The Leguminosae of Porto Rico," by Miss Janet Russell Perkins, Ph. D. In 1901 and 1902 Miss Perkins, under an appointment as scientific aid in the United States Department of Agriculture, was engaged at Berlin in a revision of the Leguminosae of Porto Rico. The revision was based upon a study of collections and literature, unaccompanied by field work in the island. It was originally intended to publish the results of this work conjointly with an account of the agricultural relations of the leguminous plants of that island, but as it proved to be necessary to postpone the preparation of this latter paper for more detailed investigation Miss Perkins's paper is now presented separately for publication. This paper differs in several respects from the systematic treatment of leguminous plants presented in other numbers of these Contributions, and such differences must be taken only as an expression of the views of the author,

The fifth paper is a "Report on the Diatoms of the Albatross Voyages in the Pacific Ocean, 1888–1904," by Dr. Albert Mann, assisted in the bibliography and citations by P. L. Ricker. In the autumn of 1887 the steamer *Albatross*, of the United States Bureau of Fisheries, which had previously been employed on the Atlantic coast of North America, was dispatched to the Pacific Ocean, where it has since been engaged in fishery and deep-sea investigations on the western coast of the United States, off British Columbia and Alaska, and also in more distant regions. The bottom samples obtained by the dredge and sounding cup during the several cruises from 1888 to 1904, inclusive, were referred to Doctor Mann, an expert student of the diatoms. He has separated and reported on these minute plant organisms, a difficult and painstaking task, the results of which are given in the paper presented herewith. With very few exceptions the titles in the bibliography and the citations throughout the body of the report have been verified by Mr. P. L. Ricker, to whom acknowledgment is here made.

The sixth paper is entitled "The Cyperaceae of Costa Rica," by C. B. Clarke. Several years ago Prof. Henri Pittier, while actively engaged in studying the plants of Costa Rica, invited Mr. C. B. Clarke, of the Kew Herbarium, then the greatest living authority on the Cyperaceae, to prepare a synopsis of the genera and species of that family found in Costa Rica. This work was gladly undertaken by Mr. Clarke. Soon after the synopsis was submitted Professor Pittier left Costa Rica to accept a position in the Department of Agriculture, in Washington, and after his arrival offered the paper to the United States National Museum for publication. Mr. Clarke having died in the meantime, it seemed desirable to publish it with as little change as possible. As it was prepared in Latin, however, the Advisory Committee on Publications recommended that it should be translated into English, and Dr. E. L. Greene was asked to prepare the manuscript. In performing this task Doctor Greene has followed as closely as possible the terms and phrasing of Mr. Clarke's papers written in English.

Further changes consist in the withdrawal of the bibliography following each species name, the arrangement of the synonymy in chronological order, and the insertion of the dates of publication. The names of periodicals have also been substituted in the citations for subtitles, and a number of names which are clearly nomina nuda have been withdrawn. One new specific name has been changed because it was found to be a homonym.

The seventh and last paper is "Studies of Tropical American Ferns—No. 1," by William R. Maxon. During the last decade the National Museum has acquired large collections of Mexican and Central American plants. These collections are rich in new material, but evidently they are not sufficiently comprehensive to warrant undertaking the publication of a general flora of any one of these countries without further exploration. In order, however, to make public the scientific results of preliminary studies of the collections a series of papers has been carried on in the Contributions from the National Herbarium, under the title "Studies of Mexican and Central American Plants," by Dr. J. N. Rose, Associate Curator. It is now proposed to begin a similar series under the title "Studies of Tropical American Ferns," by Mr. William R. Maxon, Assistant Curator. Although at present this will deal largely with Mexican and Central American collections, it will include also descriptions of new and noteworthy West Indian species. South American forms will be considered also, as circumstances may require.

FREDERICK V. COVILLE,
Curator of the United States National Herbarium.

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CONTRIBUTIONS

FROM THE

UNITED STATES NATIONAL HERBARIUM

VOLUME X, PART 1

NORTH AMERICAN SPECIES OF FESTUCA

By CHARLES V. PIPER

WASHINGTON
GOVERNMENT PRINTING OFFICE
1906

BULLETIN OF THE UNITED STATES NATIONAL MUSEUM:

ISSUED MARCH 30, 1906.

PREFACE.

The revisions of genera, descriptions of new species, and other systematic papers on grasses emanating from the Office of the Agrostologist of the Department of Agriculture have heretofore been published as Bulletins of the Bureau of Plant Industry in that Department. In view, however, of the transfer of the grass herbarium to the Office of the Botanist, the Agrostologist has suggested that the accompanying manuscript entitled "North American Species of Festuca," by Professor Charles V. Piper, be published in the series of Contributions from the United States National Herbarium. This suggestion has been adopted. The author of the manuscript regrets that it was not possible to consult all the type specimens of the American species, several of which are in European herbaria, but he considered it preferable to offer his work for publication now rather than to delay it indefinitely.

FREDERICK V. COVILLE,
Curator of the United States National Herbarium.

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NORTH AMERICAN SPECIES OF FESTUCA.

By Charles V. Piper.

INTRODUCTION.

This treatment of the North American species of Festuca is based primarily on the material in the National Herbarium, but through the courtesy of those having the collections in charge, we have been able to examine the material in the Gray Herbarium, the New York Botanical Garden, the Academy of Natural Sciences of Philadelphia, the California Academy of Sciences, the Michigan Agricultural College, and the Geological and Natural History Survey of Canada. To all of these grateful acknowledgment is made.

We have taken especial care to point out clearly the material basis for our interpretations of the various species that have been proposed. In the cases of *Festuca ovina* and *Festuca rubra* reliance is placed mainly on the classic work of Hackel in his Monographia Festucarum Europaearum, aided by a fine series of authentic specimens distributed by him. It is worthy of note that of the 30 native species of the genus in North America, here recognized, 3 have been collected but once, 2 others but twice, and a sixth species, *F. rigescens*, has been found but once north of South America. We have cited specimens only for special reasons, and have usually included only specimens of historic interest, or from numbered sets generally distributed.

HISTORY OF THE GENUS.

The name Festuca first appears in botanical literature, according to Trinius, in Dodoens's work entitled "Stirpium historiae pemptades sex, sive libri XXX Antwerpiae, ex officina Christophori Plantini," published in 1583. Dodoens's plant "*Festuca altera*" is, according to Trinius, *Bromus secalinus* L. Later pre-Linnæan authors used the name in various ways, mostly, however, for species of Bromus.

In the first edition of the Genera Plantarum, 1737, Linnæus cites two plates, namely, Dillenius, Catalogus Plantarum, plate 3, which is evidently some species of Bromus, and Scheuchzer, plate 5, figures

13 to 16, inclusive, which represent, respectively, *Bromus erectus*, *B. sterilis*, *B. arvensis*, *B. asper*, *Festuca gigantea*, and *F. elatior*.

In the fifth edition of the same work, 1754, the description, with a few very insignificant changes, is the same as in the first edition, but the citations of Dillenius and of Scheuchzer are omitted.

In the first edition of Linnæus's Species Plantarum, 1753, from which the genus must by common acceptation date, eleven species are described in the following sequence: *F. ovina*, *F. duriuscula*, *F. rubra*, *F. amethystina*, *F. myuros*, *F. maritima*, *F. decumbens*, *F. elatior*, *F. fluitans*, and *F. cristata*.

Of these species *F. decumbens* is the type of the genus Sieglingia of Bernhardi; *F. fluitans* is *Panicularia fluitans* Kuntze, and *F. cristata* is the type of the genus Koeleria of Persoon.

The remaining species are generally included by authors in the genus Festuca, so that whether we accept the first species, *F. ovina*, as the type of the genus, or follow the historic method of residues, the result in this genus is practically the same.

Numerous other genera have, however, been proposed for species usually included in, or first referred to, Festuca. Chronologically considered these are as follows:

Vulpia Gmel. Fl. Bad. **1**: 8. 1805.

Only one species included, *V. myuros* (*Festuca myuros* L.).

Schedonorus Beauv. Agrost. 99. 1812. (Spelled "Schenodorus" in the index of the same work.)

Based on seven species, of which the first is *Festuca elatior* L. Beauvois' plate also seems to be of this species, but if so it is very faulty.

Sclerochloa Beauv. Agrost. 97, 177. 1812.

Based on *Poa dura* L., *Poa procumbens* Schreb., and *Poa divaricata* Beauv., all of which are *nomina nuda*, though "*Poa dura* L." (*Cynosurus durus* L.) is evidently an error for *Poa dura* Scop. Beauvois figures *S. dura*.

Technically, perhaps, Sclerochloa is not published by Beauvois, in which view the genus would date from Beauvois in Reichenbach, Icones Florae Germanicae **1**: 23. 1834, where the first species is likewise *S. dura*.

This genus is generally accepted.

Tragus Panzer, Denkschr. Acad. München. **1813**: 296. 1814.

Nine species were included by the author, none of which are figured. The first in position is *T. elatior* (*Festuca elatior* L.).

There is an older Tragus of Haller, 1768.

Mygalurus Link, Enum. Hort. Berol. 1: 92. 1821.

Six species included, none figured, all annuals, of which the first, *M. caudatus*, is *Festuca myuros* L.

De[s]mazeria Dumort. Comm. Bot. 26. 1822.

One species, *D. sicula*, based on *Poa sicula* Jacq.

Chloammia Raf. Neogenyt. 4. 1825.

Two species cited, namely, *Festuca tenella* and *F. bromoides*. The "*Festuca bromoides*" of Michaux which is *F. tenella* Willd. is probably intended.

Dasiola Raf. Neogenyt. 4. 1825.

Based on *Festuca monandra* Ell. (*Dasiola elliotea* Raf.). This is in all probability *Festuca sciurea* Nutt.

Nardurus Reichenb.

Incidentally mentioned under *Brachypodium tenellum* Beauv. in Flora Germanica Excursoria 19. 1830, but apparently first properly published in Godron, Flore de Lorraine 3: 187. 1844.

Godron included two species in this sequence, *Nardurus tenellus*, generally known as *Festuca unilateralis* Schrad. and *N. lachenalii*, usually called *Festuca lachenalii* Spenn.

Bucetum Parnell, Grasses of Scotland 8, 104. 1842.

Four species were included in the following sequence: *B. loliaceum*, *B. pratense*, *B. elatius*, and *B. giganteum*. These are respectively *Festuca loliacea*, *F. elatior*, *F. elatior*, and *F. gigantea*. The first is *Festuca loliacea* Curtis, a hybrid between *Festuca elatior* and *Lolium perenne*. The species are all figured in the above sequence.

Micropyrum Link, Linnaea 17: 397. 1843.

Based on the single species *M. tenellum* Link, which is based on *Triticum tenellum* L. (*Festuca lachenalii* Spenn.).

Festucaria Link, Linnaea 17: 398. 1843.

Two species included, neither figured, *Festucaria tenuicula* and *F. psilantha*, both of which are now considered subspecies of *Festuca unilateralis* Schrad. The name Festucaria has also been used for a genus based on *Festuca fluitans* L. by Heister in Fabr. Enum. ed. 2, 373. 1763.

Catapodium Link, Linnaea 17: 398. 1843.

Based on *Triticum loliaceum* Smith (*Poa loliacea* Huds.).

This genus is reduced to Festuca by Bentham and Hooker, but maintained by Hackel.

Scleropoa Griseb. Spic. Fl. Rumel. 2: 431. 1844.

One species, *S. rigida* Griseb., based on *Poa rigida* L.

Maintained as a genus by many authors, reduced to Festuca by others.

Castellia Tineo, Pl. Rar. Sic. **2**: 17. 1846.

Based on a single species, *C. tuberculata* Tineo, which is *Festuca tuberculosa* (Moris) Richter.

Ctenopsis De Notaris, Ind. Sem. Hort. Gen. 352. 1847.

A single species, *C. pectinella* De Notaris. (*Festuca pectinella* Delile.). Retained as a genus by Bentham and Hooker, but reduced to Festuca by Hackel.

Leucopoa Griseb. in Ledeb. Fl. Ross. **4**: 383. 1853.

One species, *L. sibirica* Griseb. Bentham and Hooker reduce this to Poa, and Hackel to Festuca.

The species is clearly closely related to the West American Poas of the *fendleriana* group. Its only distinctive character is the awn-like excurrent midrib of the lemma, which character is approached by *Poa subaristata* Scribner. The genus, if not maintained, belongs with Poa and not with Festuca.

Amphigenes Janka, Linnaea **30**: 619. 1860.

Based on *Festuca carpathica* Dietr.

Prosphysis Dulac, Fl. Haut. Pyr. 67. 1867.

The author quotes Nardurus Reichenb. as a synonym and includes but one species, *P. tenellus*, based on *Nardurus tenellus* Reichenb. This plant is considered by Ascherson and Graebner to be the same as *Festuca maritima* L.

Synaphne Dulac, Fl. Haut. Pyr. 90. 1867.

The only species is *S. rigida* (*Scleropoa rigida* Griseb.)

Distomomischus Dulac, Fl. Haut. Pyr. 91. 1867.

The author quotes Vulpia Gmel. as a synonym and includes four species in this sequence: *D. sciuroides* (*Festuca sciuroides* Roth), *D. myuros* (*Festuca myuros* L.), *D. ciliatus* (*Festuca ciliata* Danth.) and *D. subuniglumis* (*Festuca bromoides* L.). None of these species are figured.

Drymonaetes Ehrh.

This name occurs in Ehrhart, Beiträge **4**: 147. 1789, but is first technically published as a genus in a paper by Fourreau, Ann. Soc. Linn. Lyon n. s. **17**: 187. 1869. The only species is based on *Festuca gigantea* (L.) Vill.

Loretia Duval-Jouve, Rev. Sci. Nat. II. **2**: 38. 1880.

Four species were described by the author as belonging to this genus, arranged as follows: *Loretia setacea* based on *Festuca setacea* Guss.; *L. incrassata* based on *Bromus incrassatus* Lam.; *L. geniculata* based on *Bromus geniculatus* L.; and *L. ligustica* based on *Bromus ligusticus* All. No figures are published by Duval-Jouve, but he cites plates for each of the above species.

Helleria Fourn. Mex. Pl. **2**: 128. 1886.

Based on *Bromus lividus* H. B. K. (*Festuca livida* Willd.). Included in Festuca by Bentham and Hooker and by Hackel.

An examination of the list of names shows that seven genera have been proposed for varying groups of perennial Festucas (excluding Leucopoa), and that fifteen names have been proposed for varying groups of the annual species. Of the former class none has received wide acceptation. In regard to the latter class there has been much difference of opinion.

In the great modern works on plant genera the following views are maintained: Hackel, in Engler and Prantl's Pflanzenfamilien, recognizes Festuca, Sclerochloa, Catapodium, and Scleropoa as distinct, merging the remaining proposed genera, including Ctenopsis and Leucopoa, into Festuca. Bentham and Hooker include Catapodium and Scleropoa in Festuca, unite Leucopoa with Poa, but maintain Sclerochloa and Ctenopsis. Baillon follows Bentham and Hooker.

Atropis (Puccinellia) is maintained as a genus by Hackel, but reduced to a section of Glyceria (Panicularia) by Bentham and Hooker and by Baillon. Ascherson and Graebner, in their recent treatment in Synopsis der Mitteleuropäischen Flora, unite Atropis with Festuca, into which they also merge Sphenopus and Cutandia.

We accept Hackel's delimitation of the genus, but exclude Leucopoa.

DISTRIBUTION.

The genus Festuca is represented in all parts of the world, but principally in temperate or mountain regions. In Europe there are, according to Hackel,[a] 28 perennial species, but on a different species concept Richter[b] increases this number to 103. The European annual species number about 26.

In North America we recognize 22 perennial and 12 annual species, two of each group introduced from Europe. In Mexico there are about 10 additional perennials, and in the remaining parts of tropical North America a few others.

Excluding known synonyms there are still accredited to Asia about 32 species, to Africa about 43 species, to Australasia about 10 species, and to South America about 75 species. It is altogether probable that many of these are synonyms.

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[a] Monographia Festucarum Europaearum.

[b] Plantae Europaeae.

ECONOMIC IMPORTANCE.

Several of the species of Festuca are of high agricultural value, both for grazing and for meadows. Among the former perhaps the most important is *Festuca ovina*, the sheep fescue, and its numerous subspecies, some of which are found native in most parts of the world. The most valuable American grass of this group is probably *Festuca ovina ingrata* Hackel, the "blue bunch grass" of stockmen, which ranges from British Columbia and Alberta to California and Colorado. In parts of the range country, notably the Columbia Basin, it is considered the second best of the range grasses. In Arizona and New Mexico this grass is replaced by the larger and coarser, but not less nutritious, Arizona bunch grass, *F. ovina arizonica* (Vasey) Hack. Other subspecies of *Festuca ovina* occur in alpine and subarctic regions, and furnish more or less abundant forage.

Festuca rubra L., the red fescue, occurs in abundance along both sea coasts in sandy soil, and in the West is plentiful in the mountains at low altitudes. In restricted areas it is an important forage grass.

Festuca altaica Trin. is abundant in Alaska, often covering large areas with its large tussocks. From very limited experience with it this grass seems to be quite as nutritious as its near allies.

Festuca viridula Vasey is the most nutritious grass in the mountain parks of the Cascade, Blue, and Bitter Root mountains. It often occupies large areas in nearly pure growth. Unfortunately it is unable to withstand severe grazing, and consequently where sheep have been herded this grass has well-nigh disappeared.

The annual species, especially *Festuca octoflora*, are of considerable value in semiarid grazing regions. They spring up very quickly when the rainy season begins in the fall, furnishing grazing when nothing else is available, and again in early spring they provide the first green forage.

Festuca elatior L., the tall fescue, a European species, is very valuable as a hay and pasture grass, but in this country is little grown as yet, except in the eastern portion of Kansas and Nebraska. A smaller form of it, the meadow fescue, used only in pastures and lawns, is sometimes known in this country as English bluegrass, or, technically, as *Festuca pratensis* Huds. or *Festuca elatior pratensis* Gray. According to the best European authorities, however, *F. elatior* L. and *F. pratensis* Huds. are exactly identical, so that, whatever be the distinction of the two forms agriculturally, the botanical names both belong with tall fescue.

PREVIOUSLY PUBLISHED ILLUSTRATIONS OF NORTH AMERICAN FESTUCAS.

I. In Bulletins of the Division of Agrostology:[1]

Festuca dasyclada,	Bulletin 17,	Figure 576
Festuca elatior, as *Festuca elatior pratensis*,	7,	288
Festuca elatior arundinacea,	3,	42
	14,	45
	7,	287
Festuca subulata, as *F. jonesii*,	17,	575
Festuca confinis, all as *F. kingii*,	5,	12
	12,	23
	13,	19
	17,	573
Festuca pacifica, as *F. microstachys*,	17,	578
Festuca myuros,	17,	581
Festuca shortii, as *F. obtusa*,	17,	574
Festuca octoflora,	17,	580
Festuca ovina,	5,	27
	17,	577
	12,	7
Festuca rubra,	5,	28
Festuca rubra glaucescens,	3,	43
	14,	46
	7,	289
Festuca hallii, all as *F. scabrella*,	3,	44
	5,	14
	14,	47
Festuca sciurea,	17,	579

II. In Illustrations of North American Grasses, Bulletin 13, Division of Botany:[a]

Festuca pacifica, as *F. microstachys*,	Plate 91
Festuca altaica, as *F. subulata*,	92
Festuca viridula,	93

III. In Agricultural Grasses and Forage Plants of the United States, Special Bulletin, Division of Botany, 1889:[1]

Festuca elatior,	Plate 81
Festuca ovina,	82
Festuca hallii, as *F. scabrella*.	83

IV. In Britton & Brown, Illustrated Flora:

Festuca octoflora,	Figure 497
Festuca myuros,	498
Festuca rubra,	499
Festuca ovina,	500
Festuca scabrella, (=?)	501
Festuca elatior,	502
Festuca shortii,	503
Festuca obtusa (as *nutans*),	504

V. Tenth Ann. Rep. Mo. Bot. Gard.:

Festuca rigescens,	Plate 43

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[a] U. S. Department of Agriculture.

DESCRIPTIVE TERMINOLOGY.

We have taken the liberty to introduce the word *lemma*[a] to apply to the "lower palet" or "outer palet" or "flowering glume" of authors, restricting the word "glume" to the "empty glumes." This is done purely for a practical reason, namely, to avoid the constant use of phrases for the members of the grass spikelet most used in technical descriptions.

The only other attempt to apply a single-word term to the "flowering glume" we have noticed is the word "floriglume," proposed by Prof. George Macloskie in volume 8 of the Report of the Princeton University Expedition to Patagonia. This term seems to us objectionable, because it is likely to lead to confusion with the word "glume," as applied to both empty glumes. The so-called third empty glume of some grasses is really a sterile lemma.

The use of a single distinctive name for each part of the grass spikelet seems much preferable to the employment of such general terms as bracts, bractlets, and scales.

SYNOPSIS OF UNITED STATES AND CANADIAN SPECIES.

FESTUCA L.

Festuca L. Sp. Pl. 1: 73. 1753.

Spikelets 2 to many-flowered, variously paniculate or sometimes racemose; rachilla articulate at the joints and above the glumes; florets all perfect, or the uppermost staminate; glumes 2, persisting, carinate, unequal or subequal, the lowest 1-nerved (rarely 3-nerved), the upper larger and 3-nerved (rarely 5-nerved); lemma lanceolate, usually narrow, commonly aristate, always 5-nerved, convex or subcarinate, firm in texture at least near the base, the apex and margins sometimes scarious, the callose base smooth or nearly so; palea bicarinate, oblong or lanceolate, obtuse, acute, acuminate, or bidentate at apex, usually about equaling the lemma; lodicules 2, about as long as the ovary, sometimes entire, usually bifid; stamens 3 in the perennial species, in the annuals often reduced to 1; ovary obovate, smooth or hispidulous at apex; styles very short, distinctly apical; stigmas plumose, the branches toothed; caryopsis linear or oblong, glabrous, convex dorsally, sulcate or rarely plane ventrally, often adhering to the palea; hilum linear.

KEY TO THE SPECIES.

Subgenus VULPIA. Annuals; stamens usually 1, sometimes 3, rarely becoming extruded; stigma plumose, the branches toothed, bilateral.

Spikelets densely 5 to 13-flowered; lemma without scarious margin. 1. *octoflora.*

Spikelets loosely 1 to 5, rarely 6-flowered; lemma with narrow scarious margin.

- Branches of the short panicle normally divergent, a pulvillus at the base of at least one of them.
    - Florets mostly 3 to 5 in each spikelet, only the principal panicle branches divergent.

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[a] λέμμα (λεμματ-), husk, scale.

- Spikelets not at all hirsute. 2. *pacifica.*
- Spikelets with glumes only hirsute. 3. *confusa.*
- Spikelets with lemma only hirsute. 4. *eriolepis.*
- Spikelets wholly hirsute. 5. *grayi.*
- Florets mostly 1 to 3 in each spikelet; all the spikelets divaricate.
    - Spikelets not at all pubescent. 6. *reflexa.*
    - Spikelets with only the lemma pubescent. 7. *microstachys.*
    - Spikelets wholly pubescent. 8. *eastwoodae.*
- Branches of the narrow elongated panicle erect or appressed.
    - First glume one-third to one-half as long as the second.
        - Lemma not ciliate. 9. *myuros.*
        - Lemma ciliate. 10. *megalura.*
    - First glume two-thirds to three-fourths as long as the second.
        - Lemma smooth or scabrous. 11. *bromoides.*
        - Lemma pubescent. 12. *sciurea.*

Subgenus EUFESTUCA. Perennials, mostly tufted and never with scaly rootstocks; stamens 3, protruding in anthesis; stigmas bilaterally plumose, the branches toothed.

- Plants densely tufted, or with narrow and involute blades, usually both; lemma awnless or awned.
    - Ligule short; collar and auricles not conspicuously bristly, or tomentose.
        - Blades not falling away from the sheaths; palea obtuse or bidentate at apex.
            - Innovations extravaginal; blades smooth; spikelets usually more or less glaucous. 13. *rubra.*
            - Innovations intravaginal.
                - Tufts easily separable; blades closely involute; pulvilli none or faintly developed.
                    - Awns longer than the membranous lemmas; blades soft, sulcate; ovary hispidulous at apex. 14. *occidentalis.*
                    - Awns not longer than the coriaceous lemmas; ovary glabrous.
                        - Blades various, but when hard the lemma awned. 15. *ovina.*
                        - Blades smooth, firm, rigid; lemma awnless. 16. *rigescens.*
                - Tufts separable with difficulty; blades narrow, loosely involute or flat; lemma thin; a pulvillus at the base of each ray.
                    - Lemma smooth, usually awnless, sometimes awn-pointed. 17. *viridula.*
                    - Lemma scabrous-puberulent, short-awned. 18. *howellii.*
        - Blades at length falling away from the persisting sheaths; palea notched at apex.
            - Panicle rays spreading; spikelets shining; culm and loosely involute green blades smooth or nearly so. 19. *altaica.*
            - Panicle rays erect or becoming so; spikelets dull; culm and closely involute glaucescent blades usually very scabrous. 20. *hallii.*
    - Ligule short, ciliate; collar and auricles tomentose or bristly. 21. *aristulata.*
    - Ligule 4 to 9 mm. long, scarious. 22. *thurberi.*

- Plants less densely tufted; leaves flat, green, membranaceous.
  - Lemma indurated, not at all keeled.
    - Spikelets 5 to 10-flowered; lemma awnless or rarely short awned. 23. *elatior.*
    - Spikelets 3 to 6-flowered; lemma awnless.
      - Glumes scarious-margined, much shorter than the lemma; lemma not acuminate.
        - Lemma acute; spikelets loosely scattered. 24. *obtusa.*
        - Lemma obtuse; spikelets somewhat aggregated. 25. *shortii.*
      - Glumes without scarious margins, nearly as long as the lemma; lemma acuminate.
        - Spikelets glaucous, loosely 4 to 6-flowered; lemma often with a short awn; sheaths smooth. 26. *versuta.*
        - Spikelets green, closely 2 to 3-flowered; empty glumes scabrous; sheaths short-pubescent. 27. *johnsoni.*
  - Lemma awned, membranaceous, indurated only near the base and keeled at least above the middle.
    - Floret long-stipitate at base; awn terminal. 28. *subuliflora*
    - Floret not stipitate at base.
      - Lemma plainly 5-nerved; awn from a cleft apex.
        - Spikelets 5 to 9 mm. long, 2 to 4-flowered.
          - Panicle branches ciliate; awn shorter than the lemma. 29. *dasyclada.*
          - Panicle branches not ciliate; awn as long or longer than the lemma. 30. *elmeri.*
        - Spikelets 10 to 15 mm. long, 3 to 7-flowered. 31. *gigantea.*
      - Lemma 5-nerved, the intermediate nerves very obscure; awn terminal.
        - Awn much shorter than the lemma. 32. *fratercula.*
        - Awn as long as or longer than the lemma. 33. *subulata.*

Subgenus HESPEROCHLOA. Perennials, densely tufted but producing occasional stout extravaginal scaly stolons; leaf blades broad, flat, or rarely involute; stamens 3, protruding; stigmas elongate, the numerous short mostly simple branches arising from all sides.

A single species. 34. *confinis.*

Subgenus I. VULPIA (Gmel.) Hack.

Vulpia Gmel. Fl. Bad. **1**: 8. 1805, as genus.

Vulpia Hack. in Engl. & Prantl, Nat. Pflanzenfam. $\mathbf{2}^2$: 75. 1887, as subgenus.

Annuals; stamens usually only 1, sometimes 3; florets usually remaining unopened, and consequently self-pollinated; joints of the rachilla usually clavate; stigmas plumose, the branches toothed, bilateral.

Many of the species in this subgenus present slight but remarkably constant differences. In all probability this fact is connected with their close pollination.

1. **Festuca octoflora** Walt.

Festuca octoflora Walt. Fl. Car. 81. 1788.

According to Professor A. S. Hitchcock, there is no specimen to represent this species in the part of Walters's herbarium preserved in the British Museum. The brief original description probably refers to the plant generally understood.

Festuca tenella Willd. Sp. Pl. **1**: 419. 1797. "Habitat in America boreali." We have not seen the type.

Festuca setacea Poir. Encyl. Suppl. **2**: 638. 1811. Described from specimens grown in the Jardin du Val de Grace, France, the original source unknown. We have not seen the type.

Festuca parviflora Ell. Bot. S. C. & Ga. **1**: 170. 1817. We have examined the type of this in Elliott's herbarium, and are inclined to consider it an immature shade form of *octoflora*. It is worthy of note, however, that all the specimens which match Elliott's type are from the Southern States. The type is in possession of the College of Charleston.

Festuca tenella glauca Nutt. Trans. Am. Phil. Soc. **5**: 147. 1834. Type in the herbarium of the Philadelphia Academy, collected by Nuttall at Fort Smith, Ark. The plant is scarcely glaucous.

Festuca gracilenta Buckl. Proc. Acad. Phila. **1862**: 97. 1863. Type from "northern Texas." It is exactly the same thing as *F. parviflora* Ell. The type specimen is in the herbarium of the Philadelphia Academy of Sciences.

Festuca pusilla Buckl. Proc. Acad. Phila. **1862**: 97. 1863. Type from "northern California," preserved in the herbarium of the Philadelphia Academy. It is perfectly matched by many recent collections from the same region. The awns are about equal in length to the flowering glumes.

Festuca octoflora aristulata Torr.; L. H. Dewey, Contr. Nat. Herb. **2**: 547. 1894. No type indicated, but the description of "awns equaling or somewhat exceeding the florets" calls for a different plant from the California specimen of Bigelow to which Torrey originally applied the name as a *nomen nudum*.

DESCRIPTION.

Culms slender, erect, sometimes geniculate at base, often tufted, 5 to 40 cm. high, glabrous or retrorsely puberulent, mostly 3-jointed; sheaths glabrous or pubescent, shorter than the internodes; ligule 0.5 to 1 mm. long, scarious, not decurrent; blades narrowly linear, involute or rarely flat, soft, erect or ascending, 2 to 10 cm. long; panicle narrow, erect, often reduced to a raceme or spike, 3 to 12 cm. long, sometimes secund; rays mostly solitary, 2 to 4 or sometimes even 8 mm. long, erect, rarely spreading, 3-angled, usually scabrous; spikelets oval or oblong, 5 to 9, or rarely 13 mm. long, 5 to 13-flowered; joints of the rachilla clavate, 0.5 to 0.7 mm. long; glumes subulate-lanceolate, the lower 1-nerved, 3 mm. long, the upper 3-nerved, 4 mm. long; lemma firm, convex, lanceolate, from glabrous to very scabrous, obscurely 5-nerved, 4 to 5 mm. long, attenuate into a scabrous straight awn 1 to 7 mm. long; palea lanceolate, acute, equaling the lemma, the nerves scabrous; stamen 1.

Festuca octoflora ranges throughout the United States, extending northward into British Columbia and Ontario and southward into lower California. We have seen no specimens from Mexico or from Central or South America, though it is reported from Brazil by Doell in Martius's Flora Brasiliensis as *F. tenella* Willd.

This species is very variable, as might be expected from its wide range, but for the most part the characters are too inconstant for nomenclatorial recognition. In Utah and California occur some puzzling approaches to *F. pacifica*, but otherwise there is no danger of confusing it with related species.

1a. **Festuca octoflora hirtella** subsp. nov.

Flowering glumes hirtellous; foliage more or less pubescent. Type specimen collected by C. L. Shear (no. 1962) in the Santa Catalina Mountains, Arizona, April 10, 1901. Other specimens are referred here as follows, viz:

ARIZONA:
  Tucson Mountains, *Griffiths* 2355.
  Tucson, *Toumey*, April 15, 1894.
  Santa Rita Forest Reserve, *Griffiths* 3815.
  Castle Rock, *Griffiths* 2333.
NEVADA:
  Vegas Wash, Lincoln County, *Coville & Funston* 419.
CALIFORNIA:
  Without locality, *Palmer* 654.
  Without locality, *Mrs. Bush.*
  San Bernardino Mountains, *Parish* 1530.
  Colorado Desert, *Orcutt* in 1889.
  Bishop, *M. E. Jones*, May 15, 1897.
  Old Wilson Trail, *Geo. B. Grant* 5419 in part.
  Sierra Nevada, *Lemmon* 4659.
LOWER CALIFORNIA:
  Mission Santa Gertrudis, *Orcutt*, March 10, 1899.
  Guadalupe Ranch, *Orcutt* 1432.
  Lagoon Head, *Palmer* 655.

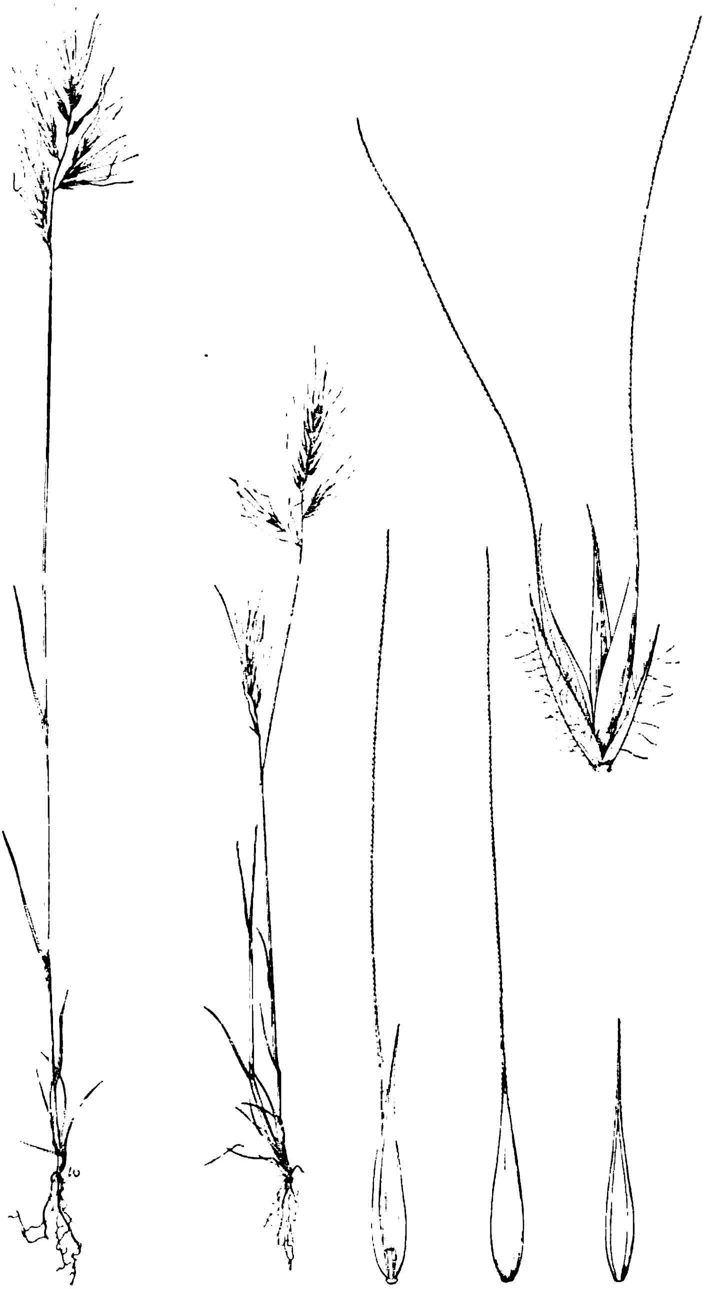
2. **Festuca pacifica** sp. nov.

Culms slender, erect, or geniculate at base, glabrous, usually 30 to 50 cm. high, 3-jointed, solitary or loosely tufted; sheaths glabrous or puberulent, striate, the lower two about as long as their respective internodes, the upper much shorter than the peduncle; ligule very short but broader than the blade, decurrent; blades narrowly linear, very acute, soft, glabrous, loosely involute, 3 to 5 cm. long; panicle more or less secund, 5 to 12 cm. long; the lower branches solitary, divaricate, bearing spikelets on the lower side nearly or quite from the base; axis and branchlets sharply 2-angled, somewhat channeled, glabrous; pedicels clavate, flattened, mostly very short; spikelets 3 to 6-flowered; joints of the rachilla cylindric, scabrous; lower glume subulate-lanceolate, 1-nerved, glabrous, 4 mm. long; upper glume lanceolate-acuminate, 3-nerved, glabrous, 5 mm. long; lemma lanceolate, scabrous excepting in the lowermost floret (this smooth), 6 to 7 mm. long, attenuate into a scabrous awn 10 to 15 mm. long; palea lanceolate, longer than the lemma, the inflexed sides half as wide as the scabrous internerve, the scabrous acuminate apex readily splitting into two awnlike teeth; perfect stamen usually one, sometimes three; grain dark-colored, lanceolate, deeply grooved, adherent to the glume and palea.

The rachilla readily breaks so that all the florets except the more persistent lowermost drop out when mature.

This is the commonest and most widespread species of the *microstachys* group, ranging from British Columbia to Lower California and Arizona, but apparently not occuring east of the Rocky Mountains. The type is Elmer's 262, collected June 20, 1896, at Pullman, Washington. Figure 91, Vol. II, Illustrations of North American Grasses, refers mainly to *Festuca pacifica*. The following collections are representative of this species:

PLATE I.



FESTUCA CONFUSA PIPER.

WASHINGTON:
Spokane, *Kreager* 4.
Western Klickitat County, *Suksdorf* 1139.
Rattlesnake Mountains, *Cotton* 472.
Almota, *Piper* 1925.
IDAHO:
Lewiston, *Sandberg, Heller, & MacDougal* 124.
Lewiston, *Heller* 3000.
OREGON:
The Dalles, *Sheldon* 10106.
Harper's ranch, Malheur County, *Leiberg* 2074.
Blue Mountains, *Griffiths & Hunter* 120.
CALIFORNIA:
Yosemite Valley, *Bioletti* 11.
Crescent City, *Davy & Blasdale* 5926.
Pine Ridge, *Hall & Chandler* 298.
San Bernardino, *Parish* 4674.
San Diego, *Orcutt* 1174.
NEVADA:
Trinity Mountains, *Watson* 1323.
ARIZONA:
Tucson, *Toumey* in 1892.
LOWER CALIFORNIA:
Guadalupe Ranch, *Orcutt*, April 6, 1886.

3. **Festuca confusa** sp. nov.

Habit of *F. pacifica*, differing in the following particulars: sheaths and blades pubescent, axis and branches of the panicle ciliate on the angles, spikelets 2 or 3-flowered; empty glumes hirsute. (PLATE I.)

The following specimens have been examined:
WASHINGTON:
Western Klickitat County, *Suksdorf* 1140 (type).
OREGON:
Grant's Pass, *Howell*, May 24, 1884.
Without locality, *E. Hall* 639.
CALIFORNIA:
Mount Diablo, *H. M. Hall* 1737, *Brewer* 1112, 1142.
Santa Lucia Mountains, *Eastwood*, May 2, 1897.

E. Hall's 639 is the plant mentioned by Doctor Gray as *Festuca microstachys ciliata* (nomen nudum) in Proceedings of the American Academy **8**: 410. It is not the plant so named and described by Beal, Grasses of North America **2**: 585.

EXPLANATION OF PLATE.—Drawn from type specimen 1140 *Suksdorf*, Western Klickitat County, Washington. Plant one-half natural size; spikelets and dissections enlarged five times.

4. **Festuca eriolepis** Desv.

Festuca eriolepis Desv. in Gay, Fl. Chil. **6**: 428. 1853. "En los campos de la Serena y en Argueros," Chile.

Festuca arida Elmer, Bot. Gaz. **36**: 52. 1903. Type collected at North Yakima, Washington, by L. F. Henderson, no. 2196. A duplicate in the National Herbarium.

We have seen only one Chilean specimen, but this, together with the long description of Desvaux, leaves no doubt that *arida* must be reduced to synonymy,

DESCRIPTION.

Culms erect or decumbent at base, 10 to 30 cm. high, 2 or 3-jointed, loosely tufted; sheaths glabrous or pubescent, the lower inflated in dwarf plants and nearly as long as the internodes; ligule very short; blades soft, narrowly linear, loosely involute, glabrous or somewhat pubescent, 2 to 8 cm. long, erect or ascending; panicle 2 to 7 cm. long, erect, narrow, the rays at length divaricate; rays solitary, scabrous on the prominent angles; spikelets 3 to 5-flowered, 10 to 13 mm. long; joints of the rachilla 7 mm. long, cylindric, hairy; glumes lanceolate, glabrous, or the midnerve scabrous above, the lower 6 to 7 mm. long, 1-nerved, or at maturity with a pair of lateral nerves at base, the upper 3-nerved, 6.5 to 7.5 mm. long; lemma lanceolate, densely villous, 6 to 7 mm. long, attenuate into a scabrous awn nearly as long; palea as long as the lemma, lanceolate, the scabrous nerves meeting in the acuminate apex, the inflexed sides about one-fourth as wide as the internerve; stamen 1. (Plate II.)

The following specimens are referable here

WASHINGTON:
- Coulee City, *Piper* 3915.
- North Yakima, *Henderson* 2196.

NEVADA:
- Reno, *Hillman*, May, 1899; *Tracy* 246.
- Smoke Creek, *Griffiths & Hunter* 514.

CALIFORNIA:
- Truckee, *Sonne* 7.
- Ukiah, *Bolander* 6118.
- Blue Lake to Jess Valley, *Griffiths & Hunter* 406.
- Castella, *Piper* 6346.

EXPLANATION OF PLATE.—Right-hand plant drawn from *Henderson* 2196, North Yakima, Washington, whence also details; left-hand plant from *Piper* 3915, Coulee City, Washington. Plants one-half natural size; details enlarged five times.

5. **Festuca grayi** (Abrams).

Festuca microstachys ciliata Gray in Beal, Grasses N. Am. **2**: 585. 1896. This is based on specimens collected by Howell at Grants Pass, Oregon, May 24, 1884. This collection is a mixture of *F. confusa* and *F. grayi*, but Beal's description refers clearly to the plant with pubescent lemmas. The type is in the herbarium of the Michigan Agricultural College; a duplicate in the National Herbarium.

Festuca microstachys grayi Abrams, Flora Los Angeles 52. 1904. Based on *Festuca microstachys ciliata* Gray.

The name *ciliata* is preoccupied in *Festuca ciliata* Danth., 1805.

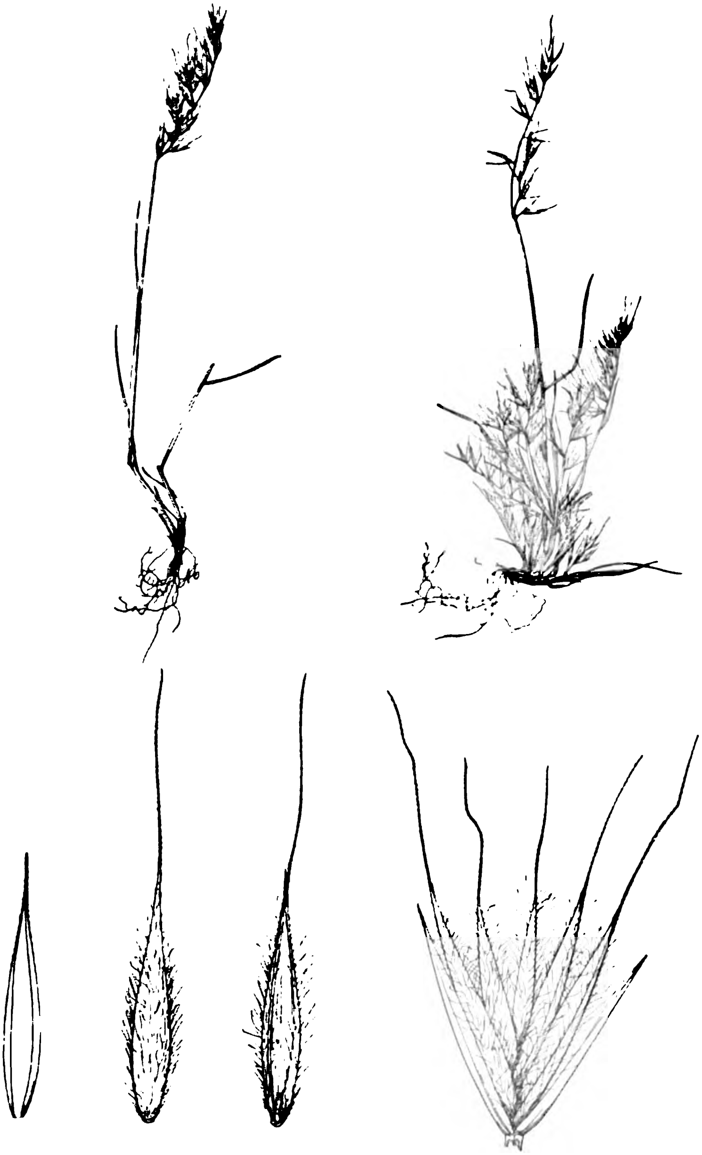
DESCRIPTION.

Habit of *Festuca pacifica*, but somewhat stouter; sheaths and sometimes the blades pubescent. Inflorescence pubescent or puberulent throughout. Spikelets 3 to 5-flowered. (PLATE III.)

The following specimens have been examined:

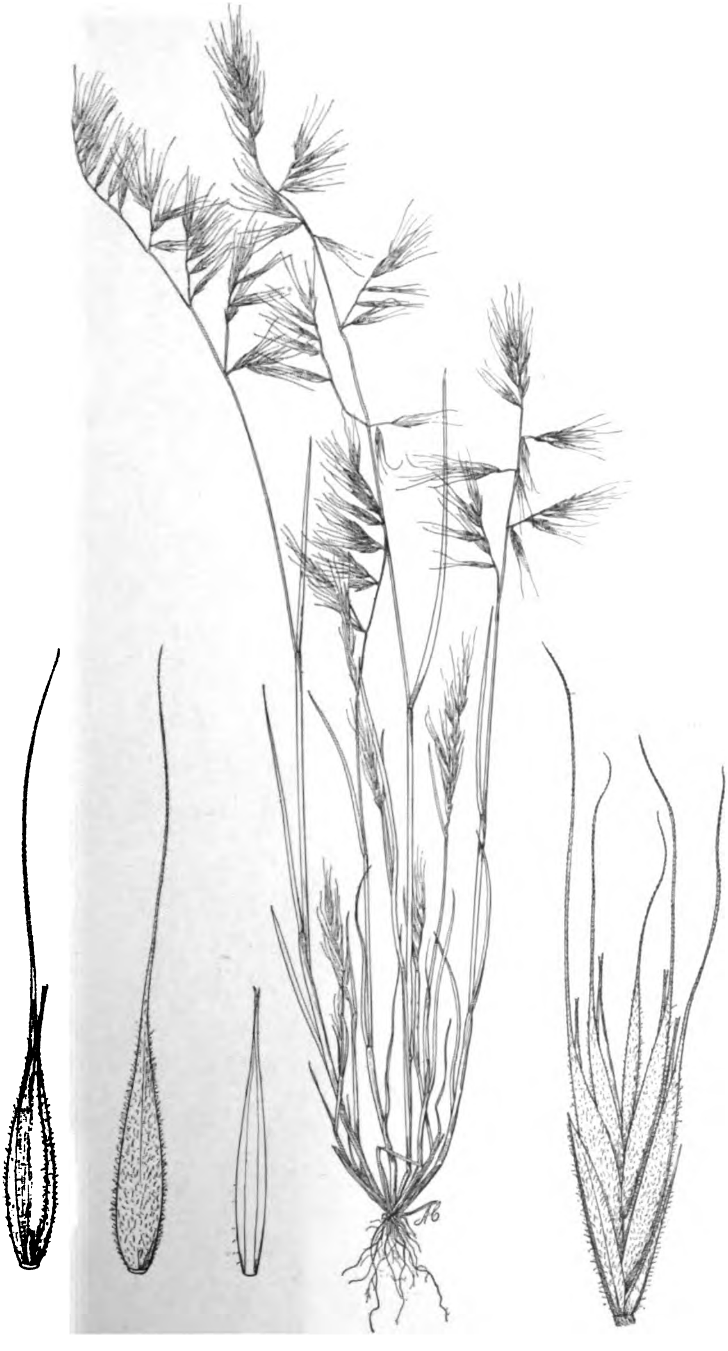
OREGON:
- Grants Pass, *Howell*, May 24, 1884 (in part), (type of *F. microstachys ciliata* Gray in Beal).

CALIFORNIA:
- New York Falls, Amador County, *Hansen* 632.
- Ojai Valley, *Hubby* 40.
- Pasadena, *Allen*, March 31, 1885.
- Santa Lucia Mountains, *Eastwood*, May, 1897.
- Geysers, *Bolander* 37.
- Napa Valley, *Bigelow*.
- Laguna, *Schoenfeldt* 3634.

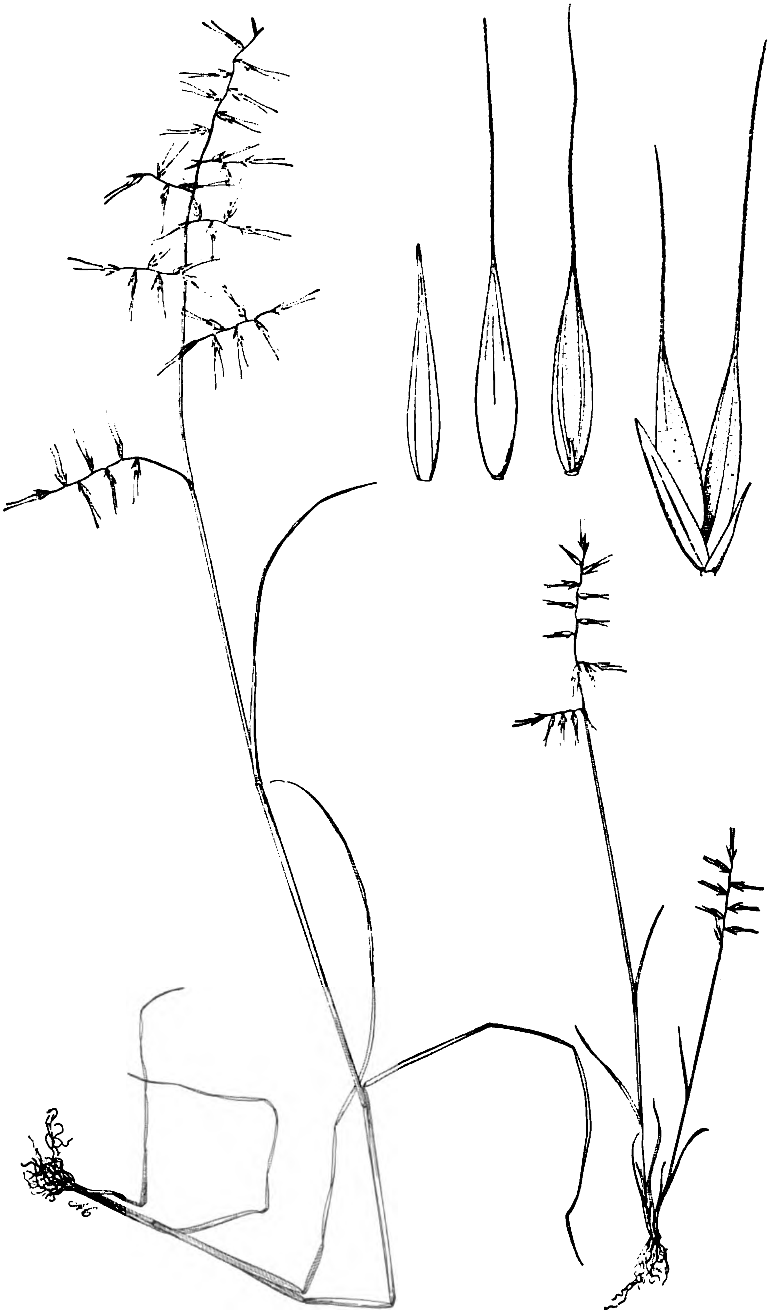


Festuca eriolepis Desv.

PLATE III.



FESTUCA GRAYI (ABRAMS) PIPER.



FESTUCA REFLEXA BUCKL.

ARIZONA:

Santa Catalina Mountains, *Shear* 1963.
Tucson, *Toumey*, in 1892.
Pima Canyon, *Griffiths & Shear* 2621.
Sabenio Canyon, *Griffiths* 2533.

A specimen collected at Los Angeles, California, by Dr. H. E. Hasse in 1888 is quite intermediate between *grayi* and *pacifica*.

EXPLANATION OF PLATE.—Drawn from Pringle's specimens from the Santa Catalina Mountains, Arizona (April 19, 1884). Plant one-half natural size; spikelet and dissections enlarged five times.

6. **Festuca reflexa** Buckl.

Festuca reflexa Buckl. Proc. Acad. Phila. **1862**: 98. 1863. Type in the herbarium of the Philadelphia Academy, collected by Nuttall in "Upper California."

Festuca microstachys pauciflora Scribner in Beal, Grasses N. Am. **2**: 586. 1896.

DESCRIPTION.

Culms erect, simple or few in a tuft, 20 to 50 cm. high, glabrous, 3-jointed; sheaths smooth or pubescent, the lower about as long as the internodes; ligule very short, membranaceous, truncate; blades narrowly linear, flat or loosely involute, 2 to 10 cm. long; panicle 5 to 12 cm. long, the rays solitary, these and the spikelets all at length divaricate; spikelets 1 to 3, or rarely 4 or 5-flowered, 5 to 7 mm. long; glumes glabrous, the lower subulate, 1-nerved, 2.5 to 4 mm. long, the upper lanceolate, acute, 3-nerved, 4.5 to 5 mm. long; lemma lanceolate, convex, 3-nerved above, glabrous or more or less scabrous, 4.5 to 6 mm. long, attenuate into a scabrous awn 2 to 12 (usually 5 to 8) mm. long; palea lanceolate, the two hispidulous nerves meeting at the acuminate apex, the inflexed sides narrow, the internerve scaberulous. (PLATE IV.)

This species is abundant throughout California, extending sparingly into Utah and western Oregon. Also on Vancouver Island, *Macoun*. Occasional specimens approach *F. pacifica* closely.

The following collections are representative:

NEVADA:

Mica Mine, *M. E. Jones* 5072 K.

CALIFORNIA:

Bakersfield, *Davy* 1898.
San Diego, *Orcutt* 1073.
Panamint Mountains, *Coville & Funston* 775.
Mendocino County, *Blankinship* 57.
Berkeley, *Michener & Bioletti* 102.
Mount Diablo, *Brewer* 1077.

UTAH:

Santa Clara Valley, *M. E. Jones* 5139 v.
Silver Reef, *M. E. Jones* 5163 aq.

EXPLANATION OF PLATE.—Taller drawing represents 71 *Brandegee*, Santa Inez Mountains, California; the shorter one, *Brewer* 1077, Mount Diablo, California, the details from the former. Plant one-half natural size; spikelets and dissections enlarged five times.

7. **Festuca microstachys** Nutt.

Festuca microstachys Nutt. Journ. Acad. Phila. n. s. **1**: 187. 1847. "Pueblo de los Angeles, Upper California."

We have been unable to locate Nuttall's type specimen. It is not at Kew nor in the Philadelphia Academy of Sciences. Nuttall's description, however, is so complete that it is hardly possible to mistake the plant.

DESCRIPTION.

Stems erect, glabrous, 20 to 50 cm. high, 2 or 3-jointed; sheaths smooth or pubescent, the lower nearly equaling the internodes; ligule nearly obsolete; blades flat or loosely involute, narrowly linear, glabrous or pubescent, 3 to 10 cm. long; panicle erect, 4 to 10 cm. long, the solitary rays and the spikelets all at length divaricate; spikelets 1 to 3-flowered, 5 to 7 cm. long; glumes unequal, the lower subulate, 1-nerved, 3 to 4 mm. long, the upper lanceolate, 3-nerved, 4 to 5 mm. long; lemma lanceolate, convex, 4 to 6 mm. long, pubescent, attenuate into a scabrous awn as long or shorter; palea acuminate, equaling the lemma.

The following specimens have been examined:

OREGON:

Grave Creek, *Howell*, May 20, 1884 (in part).

CALIFORNIA:

Salt Creek, Tulare County, *Eastwood*, May, 1894.
South Pasadena, *Allen*, April 4, 1885.
Napa City, *Jepson*, April, 1893.
Lake County, *Blankinship*, June 3, 1893.

8. **Festuca eastwoodae** sp. nov.

Culm erect, glabrous, 4-jointed, 30 cm. high; lower sheaths equaling or exceeding their respective internodes, puberulent or glabrous; ligule very short; blades soft, loosely involute, sharply acute, puberulent or glabrous; panicle open, 10 cm. long, pubescent throughout; rays and spikelets all divaricate; glumes lanceolate, the lower 1-nerved, 2 to 2.5 mm. long, the upper 3-nerved, 3.5 mm. long, hirsute; lemma lanceolate, hirsute, 4 or 5 mm. long, tipped with a straight scabrous awn as long or longer.

Collected by Miss Alice Eastwood, May, 1897, at Milpitas ranch, Santa Lucia Mountains, Monterey County, California, and by an unknown collector at Volcano, May, 1886.

Differs from *F. microstachys* Nutt. essentially in its hirsute glumes.

9. **Festuca myuros** L.

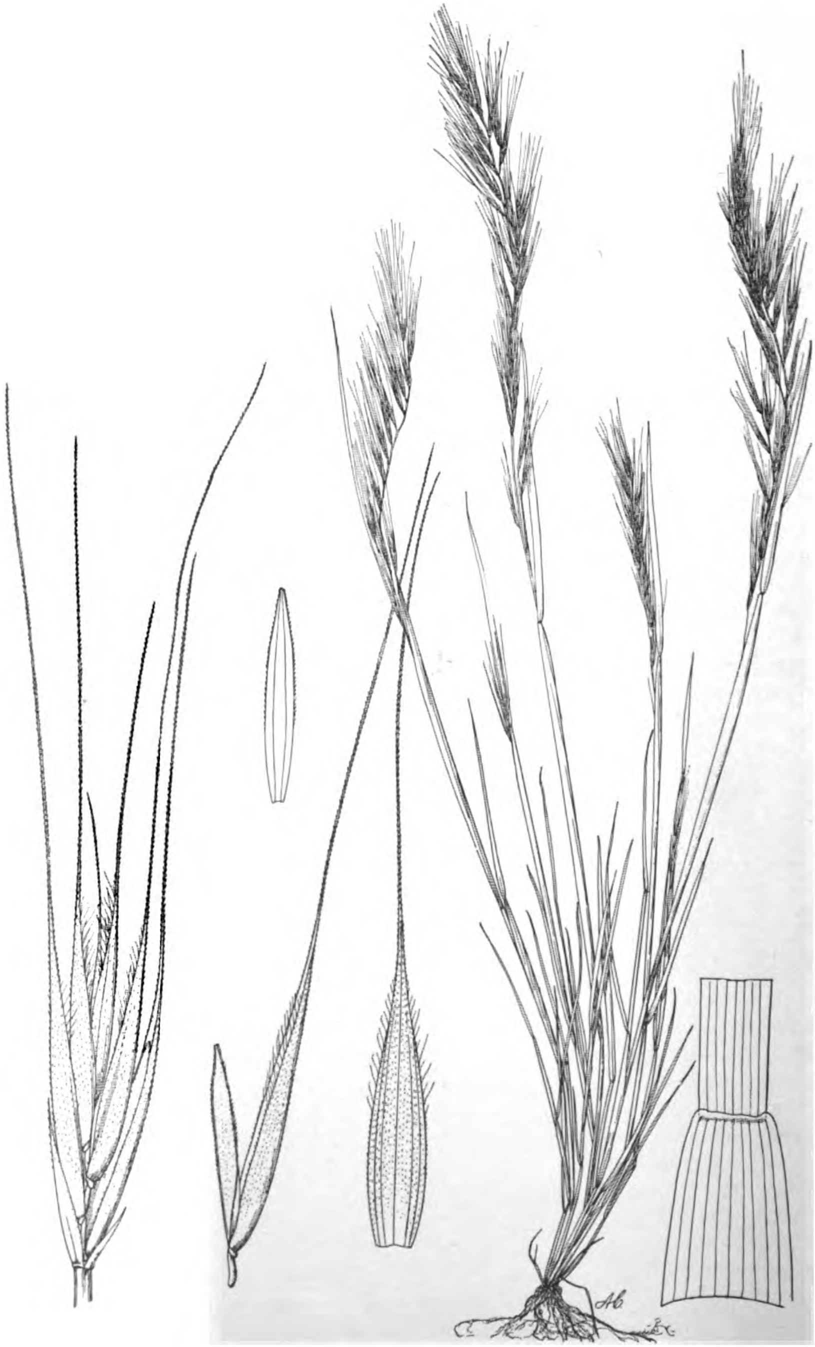
Festuca myuros L. Sp. Pl. 1: 74. 1753. "Habitat in Anglia, Italia."

DESCRIPTION.

Stems erect, sometimes geniculate at base, solitary or forming small tufts, usually 20 to 60 cm. high, glabrous, 3-jointed, usually completely concealed by the sheaths; sheaths always smooth, exceeding the internodes; ligule very short, truncate; blades smooth, linear, involute or rarely flat; panicle long and narrow, 7 to 20 cm. long, the branches appressed, the tips usually bending over; rays solitary; spikelets pale green, 4 or 5-flowered, 8 to 11 mm. long, on stalks 1 to 2 mm. long; joints of the rachilla cylindric, smooth; glumes glabrous, very unequal, the lower 1-nerved, 1.5 to 2 mm. long, the upper 4 to 5 mm. long, with two small lateral nerves; lemma linear-lanceolate, obscurely 5-nerved, scabrous above, not ciliate, attenuate at apex into a scabrous awn about twice its length; palea lanceolate, shorter than the lemma, the nerves hispidulous; stamen 1.

This European plant is commonly introduced in the eastern United States, but as yet it is rare in the interior and on the Pacific slope. Indistinguishable from it so far as we can see is the South American *Festuca muralis* Kunth, Syn. Pl. 218. 1822.

PLATE V.



FESTUCA MEGALURA NUTT.

Kunth himself first referred this plant to *F. myuros* L. (H. B. K. Nov. Gen. et Sp. **1**: 155.), remarking: "Non video quo charactere distinguenda sit a *Festuco myuro* Linn.?" Nevertheless, he later names the plant *F. muralis*, without pointing out wherein it differed. Kunth's figure in H. B. K. shows no character whatever by which his plant can be differentiated from *F. myuros*. The interesting question at once arises as to whether Kunth's plant is native or not. His type came from garden walls in Quito, Ecuador, and might well have been introduced there prior to 1815. The question is somewhat complicated by Jameson's no. 232, also collected at Quito in 1856, in sandy places and on garden walls. The sheet of this number in the Gray Herbarium is a mixture of *myuros* and *megalura*. It is hardly possible that Kunth's type can be the latter species, as he would surely have noticed the bristly cilia, especially as he was trying to differentiate his plant from *F. myuros*. As both the species grow at Quito, it will require an examination of Kunth's type to settle definitely what his *F. muralis* is, but it is altogether probable that it is true *F. myuros*, and not *F. megalura*. It may further be added that the Jameson specimen and one collected on Mount Iztaccihuatl, Mexico, by Charles Deam (no. 22), are the only American specimens of *F. myuros* which we would hesitate to consider introduced.

10. **Festuca megalura** Nutt.

Festuca megalura Nutt. Journ. Acad. Phila. n. s. **1**: 188. 1847. Type from Santa Barbara, Cal., but we have been unable to locate it in any American herbarium, nor is it in the British Museum. Nuttallian specimens of this species, with a different unpublished name, are in the Philadelphia Academy and in the British Museum. Nuttall's description is so good, however, that there can be no doubt regarding the plant.

Vulpia myuros hirsuta Hack. Cat. Gram. Port. 24. 1880. Type from Portugal.

Festuca myuros hirsuta Asch. & Graebn. Syn. Mitteleur. Fl. **2**: 558. 1901.

DESCRIPTION.

Very similar in all respects to the preceding species; panicles usually longer; lemma sparsely ciliate on its upper half. (Plate V.)

This plant is abundant on the Pacific slope from British Columbia and Idaho to Mexico and Lower California. It also recurs in Ecuador, Peru, Bolivia, and Chile. The evidence points very strongly to its being native and not introduced. In Europe it has been found only in Portugal, and that in comparatively recent years, so that it is more likely an introduction there than vice versa. It was collected in British Columbia by Lyall in 1859, in Washington by Doctor Cooper in 1853 and by Tolmie much earlier, in California by Gambell before 1847, in Nevada by Anderson in 1865, in Ecuador by Jameson in 1856, in Peru by the Wilkes expedition in 1839, and in Chile by Gay about 1850. This widespread range along the Pacific slope of both North and South America at such early dates, taken in contrast with its very local distribution in Europe, points to its being a West American native. Nevertheless, in eastern Washington and Idaho it is a plant of very recent introduction, and in its rapid spread behaves like many weedy plants of undoubted European origin.

Most of the South American specimens referred to *Festuca muralis* Kunth belong to *F. megalura*, and authentic material from Gay shows that such was the case with the specimens on which the *F. muralis* of the Flora Chilensis was based.

The character by which *megalura* is distinguished from *myuros* is very slight, but surprisingly constant. It has been mistaken by some recent California collectors for the European *Festuca ciliata* Danth. (*F. myuros ciliata* Cosson).

The following collections are representative:

BRITISH COLUMBIA:
- Victoria, *Macoun* 185.

WASHINGTON:
- Clallam County, *Elmer* 1914.
- Seattle, *Piper* 836.
- Walla Walla, *Shear* 1587.
- Waitsburg, *Horner* 557.

IDAHO:
- Lewiston, *Heller* 3232.
- Clearwater River, *Sandberg*, *Heller*, & *MacDougal* 291.

OREGON:
- Hoover Canyon, Gilliam County, *Leiberg* 150.
- Silverton, *Hall* 637.
- Portland, *Sheldon* 10505.

CALIFORNIA:
- San Bernardino, *Parish* 4761.
- San Francisco, *Torrey* 576.
- San Diego, *Brandegee* 97.
- Monterey, *Davy* 7245.
- Santa Barbara, *Elmer* 3832.
- Santa Rosa, *Heller* 5681.
- San Diego, *Grant* 896a.
- Mendocino, *Brown* 762.
- Humboldt Bay, *Chandler* 1120.

ARIZONA:
- Fort Huachuca, *Palmer* 465.

MEXICO:
- Foothills of Iztaccihuatl, *Deam* 22.
- Nachoguero Valley, Lower California, *Schoenfeldt* 3442.

EXPLANATION OF PLATE.—Drawn from 150 *Leiberg*, collected in Oregon. Plant one-half natural size; details enlarged five times.

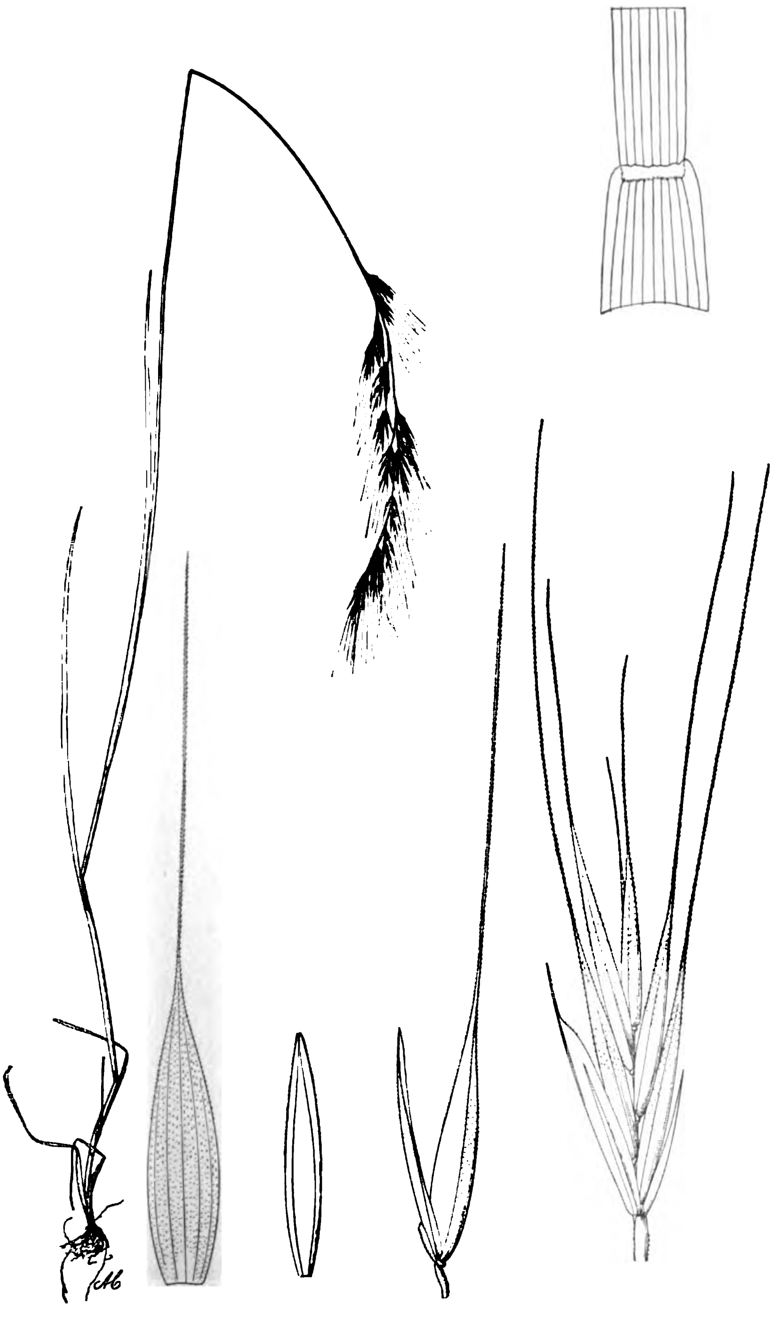
11. **Festuca bromoides** L.

Festuca bromoides L. Sp. Pl. **1**: 75. 1753. "Habitat in Anglia, Italia."
Festuca sciuroides Roth, Cat. Bot. **2**: 11. 1800.

DESCRIPTION.

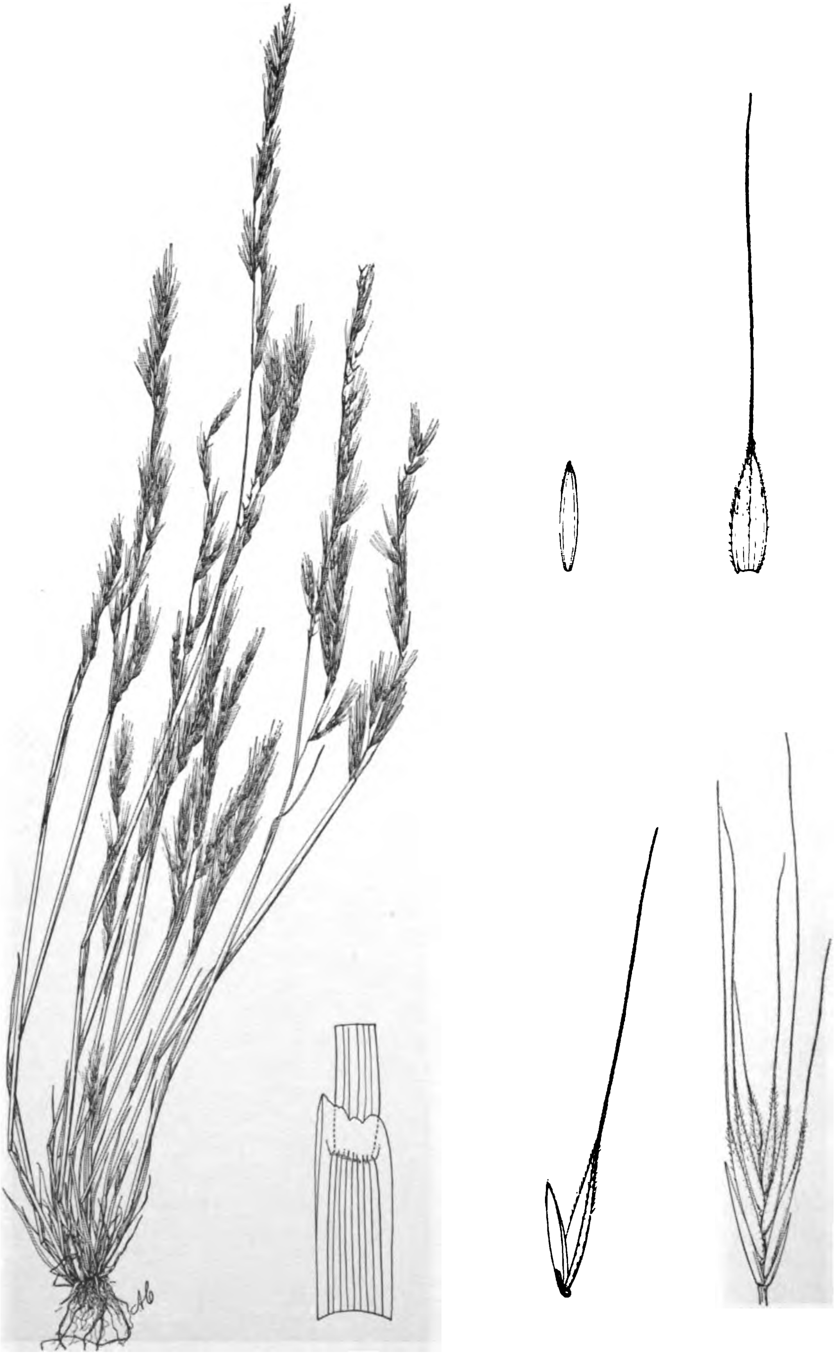
Stems erect, rarely geniculate at base, 10 to 30, rarely 40 cm. high, glabrous, 3-jointed; sheaths smooth, longer than the internodes; ligule very short; blades linear, glabrous, flat or loosely involute; panicle usually dense, narrow, 5 to 10 cm. long, seldom longer; rays solitary, rather short, appressed; spikelets pale green, 4 or 5-flowered, 9 to 12 mm. long, on stalks 2 to 5 mm. long; glumes unequal, the lower 1-nerved, 4 to 4.5 mm. long, the upper 3-nerved, 6 to 7 mm. long; lemma lanceolate, scabrous above, 7 to 8 mm. long, attenuate into an awn 10 to 13 mm. long; palea lanceolate, obtuse at the very apex, the nerves hispidulous; stamen 1. (Plate VI.)

This plant is abundantly introduced on the Pacific coast from Vancouver Island to southern California, but apparently not elsewhere in North America. The oldest specimens we have seen bear the date of 1886. Collectors have for the most part labeled it *myuros* or *microstachys*. From the former it is easily distinguished by its different glumes. Normal forms of *F. pacifica* are easily distinguished by the divaricately branching panicle, but shade or diminutive forms simulate *bromoides* closely. The best distinction in such cases is furnished by the palea. In *pacifica* the inflexed



FESTUCA BROMOIDES L.

PLATE VII.



FESTUCA SCIUREA NUTT.

sides of the palea are half as wide as the internerve; in *bromoides* they are much narrower. Furthermore the sheaths of *bromoides* are always perfectly glabrous; in *pacifica* they are often puberulent.

The following are representative collections:

British Columbia:
- Vancouver Island, *Macoun* 17, 44.
- Nanaimo, *Macoun* 186.

Washington:
- Montesano, *Heller* 3890.
- Morrison, *Leckenby* 104.
- Seattle, *Howell* 203.
- Tacoma, *Flett* 2234 in part.

Oregon:
- Portland, *Sheldon* 10669, 10801.
- Seaside, *Shear & Scribner* 1721.

California:
- Santa Cruz Island, *Brandegee* 67.
- Fort Bragg, *Davy* 6132.
- Marin County, *Palmer* 2041.
- Berkeley, *Blankinship* 12; *Davy* 7870.
- Santa Rosa, *Heller* 5221.

Explanation of Plate.—Drawn from 7870 *Davy*, Berkeley, California. Plant one-half natural size; spikelets, details, and dissections enlarged five times.

12. **Festuca sciurea** Nutt.

Festuca sciurea Nutt. Trans. Am. Phil. Soc. II. 5: 147. 1837. Type in the herbarium of the Philadelphia Academy of Sciences, collected by Nuttall in Arkansas.

There are two older names which in all probability refer to this species. One of these is *F. quadriflora* Walt. Fl. Car. 81. 1788. There seems to be no type or authentic specimen of this in existence, and the brief description of Walter is insufficient. But *sciurea* seems to be a commoner grass in South Carolina even now than *F. myuros*, to which *quadriflora* is usually referred, and it would seem that Walter must have known the plant. There is an older *Festuca quadriflora* Honck., 1782.

The other name is that of *F. monandra* Ell.[a] Elliott mentions this name under a description headed *Festuca myuros*, stating that he once considered his plant distinct from the latter, adding moreover that "the only circumstances which still occasion any doubt, the hairy corolla and solitary filaments," are omitted by Lamarck in the description of *F. myuros* in the Encyclopedie Methodique. Upon *Festuca monandra* Ell., Rafinesque founds his *Dasiola elliotea*, Neogenyt. 4. 1825.

There is no specimen to be found in Elliott's herbarium labeled either *F. myuros* or *F. monandra*, but his character of hairy corolla points clearly to *F. sciurea* as the plant he had before him. The other distinctive characters of *sciurea*, the empty glumes and small florets, are not brought out in Elliott's description.

DESCRIPTION.

Culms erect, slender, glabrous, 15 to 50 cm. high, solitary or in small tufts, 2-jointed; sheaths smooth, shorter than the internodes; ligule scarious, short, truncate; blades setaceous, soft, involute, 1 to 10 cm. long; panicle narrow, erect, 5 to 20 cm. long; rays solitary or the lower in twos or threes, smooth, sharply angled; spikelets 4 to 6-flowered, 4 to 5 mm. long; glumes smooth, the lower 1-nerved, 2 mm. long, the upper 3-nerved, 3.5 mm. long; lemma linear-lanceolate, faintly 5-nerved, 3 to 3.5 mm. long, sparsely short-pubescent, attenuate into a slender awn 6 to 11 mm. long; palea lanceolate, obtuse or acutish, nearly as long as the lemma, ciliate at the apex; stamen 1. (PLATE VII.)

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[a] Elliott, Bot. S. C. & Ga. 1: 170. 1821.

This species ranges from Norfolk County, Virginia (Kearney), south to Florida, thence westward to Texas and northward into Arkansas and Indian Territory (Palmer).

EXPLANATION OF PLATE.—Drawn from Reverchon's Texas specimen collected in 1882. Plant one-half natural size; details enlarged five times.

Subgenus II. EUFESTUCA Griseb.

Eufestuca Griseb. Spic. Fl. Rumel. **2**: 432. 1844.

Perennials, often densely tufted; stamens and stigmas projecting during anthesis; stigmas plumose, the branches toothed, bilateral.

13. **Festuca rubra** L.

Festuca rubra L. Sp. Pl. **1**: 74. 1753. "Habitat in Europae pratis siccis."

Festuca vallicola Rydb. Mem. N. Y. Bot. Gard. **1**: 57. 1900. Type in the Herbarium of the New York Botanical Garden; a duplicate in the National Herbarium, collected at Silver Bow, Montana, by Rydberg (no. 2108).

DESCRIPTION.

Stems from elongated or sometimes short creeping rootstocks, in the latter case somewhat tufted; culms erect, very smooth, 40 to 90 cm. high, 3 or 4-jointed; sheaths very smooth, shorter than the internodes; ligule scarious, short and truncate; blades very smooth, soft, the basal ones loosely involute, those of the culm typically flat, but in American forms usually folded or involute; panicle 5 to 20 cm. long, usually contracted and narrow; rays mostly erect, narrow, scabrous on the angles, the lower ones usually with a short basal branch; spikelets usually 4 to 6-flowered, rarely 10-flowered, mostly 7 to 8 mm. long, pale green or more or less glaucous, often purple-tinged; joints of the rachilla smooth; glumes smooth, the lower 1-nerved, shorter than the 3-nerved upper one; lemma linear-lanceolate, convex, obscurely 5-nerved, 5 to 7 mm. long, smooth or scabrous toward the apex, bearing a scabrous awn rarely as long, usually about half as long.

Festuca rubra is much less rich in subspecies than is *F. ovina*, and these subspecies are for the most part but ill defined. It necessarily results, therefore, that under the species proper must be grouped plants of somewhat diverse aspect. Indeed, it may be a more philosophical treatment to reduce most of the subspecies to the species, instead of keeping them up as is done by most European botanists. The problem is complicated by the fact that much of the North American *rubra* differs from the typical plant of Europe, more especially in the fact that the culm leaves tend to be involute rather than flat, in this respect approaching *F. rubra trichophylla* (Ducros) Gaud. This slight difference is surely not sufficient, however, to justify the erection of a new species for the Rocky Mountain form as proposed by Doctor Rydberg, even were the character constant, which is not the case.

Festuca rubra ranges in North America along the Atlantic seaboard from Greenland to Virginia; on the Pacific side it is abundant along the seashore from Alaska to California, and inland to the Rocky Mountains south as far as Colorado.

The specimens referred to as *F. ovina trachyphylla* Hack., *F. ovina duriuscula* (L.) Hack., *F. ovina borderii* Hack., *F. amethystina* L., and *F. rubra trichophylla* Gaud. by Doctor Beal in Grasses of North America, clearly are *Festuca rubra*. Of the specimens referred to *F. rubra fallax* Hack., the Anderson specimen is *F. ovina ingrata* Hack.; the Howell specimen, *F. rubra*.

The American forms may be recognized by the following key:

KEY TO THE SUBSPECIES OF FESTUCA RUBRA.

- Spikelets glabrous or merely scaberulous.
  - Blades of the innovations involute, of the culm flat or folded; panicle not densely congested.
    - Leaves and usually the spikelets green.
      - Florets not proliferous.
        - Spikelets 7 to 8 mm. long .... *rubra.*
        - Spikelets 10 to 12 mm. long .... *rubra megastachys.*
      - Florets proliferous .... *rubra prolifera.*
    - Leaves and spikelets glaucescent .... *rubra glaucodea.*
  - Blades all plane.
    - Spikelets green; lemmas lanceolate .... *rubra multiflora.*
  - Blades all involute, rather rigid; panicle very dense.
    - Leaves green; spikelets glabrous or glaucous .... *rubra densiuscula.*
    - Leaves and spikelets very glaucous .... *rubra pruinosa.*
- Spikelets pubescent with short hairs .... *rubra kitaibeliana.*
- Spikelets villous, often somewhat woolly .... *rubra lanuginosa.*

13a. **Festuca rubra megastachys** Gaud.

Festuca rubra megastachys Gaud. Fl. Helv. **1**: 287. 1828. Type from Switzerland.

Festuca rubra diversifolia Gaud. op. cit. 288. Type from Switzerland.

Festuca oregona Vasey, Bot. Gaz. **2**: 126. 1877. Type specimen in the National Herbarium from Oregon.

Festuca rubra grandiflora Hack. Mon. Fest. 139. 1882. Based on *F. rubra diversifolia* Gaud.

The following specimens are referred here:

CANADA:
  Point Seche, Gaspé, *Macoun* 37.
NEW JERSEY:
  Absecum, *Commons* 185.
ALASKA:
  Attah Island, *Macoun* 22806.
BRITISH COLUMBIA:
  Nanaimo, *Macoun* 29682.
WASHINGTON:
  Klickitat County, *Suksdorf* 1140.
  Klickitat River, *Suksdorf* 1147.
OREGON:
  Sauvies Island, *Howell*, June 15, 1882.

13b. **Festuca rubra prolifera** subsp. nov.

The plant of the White Mountains which has been referred to *F. ovina vivipara* L. is in reality a viviparous form or state of *F. rubra*, differing only in its viviparous spikelets. It is said to be the only form of the plant occurring in the White Mountains, and while properly a state rather than a subspecies, may be named as above. It seems surprising that no similar form occurs in Europe.

The type is a specimen in the National Herbarium collected on Mount Washington by Pringle in 1877.

13c. **Festuca rubra glaucodea** nom. nov.

Festuca glaucescens Hegetschwein & Heer, Fl. Schweiz. 93. 1840. Type locality, Switzerland. Not *F. glaucescens* Roth, Nov. Pl. Sp. 78. 1821, nor *F. ovina glaucescens* Link, Hort. Berol. **2**: 266. 1813.

Festuca rubra glaucescens Hack. Mon. Fest. 139. 1882.

The following specimens are referred here:

TENNESSEE:
Nashville, *Gattinger*.

NORTH CAROLINA:
Buncombe County, *Biltmore Herbarium* 1848b.

WYOMING:
Johnson County, *Williams & Griffiths* 177.

OREGON:
McMinnville, *Shear* 1771.

MEXICO:
Sierra Madre, near Colonia Garcia, *Townsend & Barber* 114.

13d. **Festuca rubra multiflora** (Hoffm.) Asch. & Graebn.

Festuca multiflora Hoffm. Deutschl. Fl. ed. 2. 1^1: 50. 1800. Type from Germany.

Festuca rubra multiflora Asch. & Graebn. Syn. Mitteleur. Fl. **2**: 499. 1900; op. cit. Index 43. 1903.

The following specimens are referred here:

MAINE:
Fort Kent, *Fernald* 2186.

WYOMING:
North Fork Clear Creek, *Williams & Griffiths* 91, 146, 135a.

CALIFORNIA:
Without locality, *Kellogg & Harford* 1118.
Lake Tahoe, *Hitchcock*, July, 1901.
Bear Valley, *Lemmon* 5434.

WASHINGTON:
Spangle, *Suksdorf* 119.

13e. **Festuca rubra densiuscula** Hack. subsp. nov.

Leaves all involute, smooth, rigid, green; panicle dense, 3 to 5 cm. long; spikelets glabrous, often glaucous.

The following specimens are in the National Herbarium:

CALIFORNIA:
Crescent City, *Davy & Blasdale* 5931 (type), 5932.

OREGON:
Tillamook Bay, *Howell* 74.

FRANCE:
Cherbourg, *L. Corbiere*, June 6, 1886.

13f. **Festuca rubra pruinosa** Hack.

Festuca rubra pruinosa Hack. in Rep. Bot. Exchange Club Brit. Isles 119. 1884. Type specimens from the Isle of Skye.

Festuca rubra littoralis Vasey; Beal, Grasses N. Am. **2**: 607. 1896. Type in herbarium Michigan Agricultural College, collected at Tillamook Bay, Oregon, by Howell, "on sand dunes by the sea." A duplicate specimen is in the National Herbarium.

The following specimens have been examined:

CALIFORNIA:

Fort Bragg, *Davy & Blasdale* 6117.
Point Reyes Peninsula, *Davy* 6811.

OREGON:

Tillamook Bay, *Howell*, July, 1882.

13g. **Festuca rubra kitaibeliana** (Schultes).

Festuca barbata Schrank, Prim. Fl. Salisb. 46. 1792, not L. 1759.

Festuca pubescens Willd.; Link, Enum. **1**: 91. 1821, not Zea; R. & S. Syst. **2**: 728. 1817. "In Hungaria."

Festuca rubra subvillosa Mert. & Koch in Röhling, Deutschl. Fl. ed. 3. **1**: 654. 1823, not *F. duriuscula subvillosa* op. cit. 648.

Festuca rubra villosa Mert. & Koch in Röhling, Deutschl. Fl. ed. 3. **1**: 654. 1823, not *F. ovina villosa* Schrad. Fl. Germ. **1**: 320. 1806.

Festuca kitaibeliana Schult. Mant. **2**: 398. 1824. New name proposed for *F. pubescens* Willd.

Bromus secundus Presl, Rel. Haenk. **1**: 280. 1830. Type specimen from Nootka Sound, Vancouver Island, collected by Haenke; a duplicate in the herbarium of the Missouri Botanical Garden.

Festuca rubra barbata Hack. Mon. Fest. 139. 1882. Based on *F. barbata* Schrank.

Festuca rubra pubescens Vasey; Beal, Grasses N. Am. **2**: 607. 1896. Type in herbarium Michigan Agricultural College, collected in Oregon by Howell.

Festuca rubra secunda Scribner, Rep. Mo. Bot. Gard. **10**: 39. 1899. Based on *Bromus secundus* Presl.

This much-named plant ranges in North America from Alaska to Greenland, southward to Oregon, Wyoming, Ontario, and New Brunswick. Specimens from South Burlington, Vermont (*Jones*), and Andover, New Hampshire (*Briggs*), are probably introduced. Viviparous forms occur occasionally. Some Alaskan specimens have exceptionally large spikelets nearly 2 cm. long, but otherwise show no differences.

13h. **Festuca rubra lanuginosa** Mert. & Koch.

Festuca dumetorum Rafn. Danm. Holst. Fl. **1**: 549. 1796, not L. 1762.

Festuca arenaria Osbeck in Retz. Suppl. Prim. Fl. Scan. **1**: 4. 1805, not Lam. 1791.

Festuca rubra arenaria Fries, Fl. Halland. 28. 1818.

Festuca villosa Schweigg, in Hagen, Chlor. Boruss. 35. 1819, not *F. ovina villosa* Schrad. 1806.

? *Festuca oraria* Dum. Agrost. Belg. 105. 1823.

Festuca rubra lanuginosa Mert. & Koch in Röhling, Deutschl. Fl. ed. 3. **1**: 654. 1823. "Auf magerm Flugsande am Gestade des Meeres in Hinterpommern und Ostpreussen (der Kurischen Nehrung)."

Festuca baltica Homann, Fl. Pomm. **1**: 56. 1828.

Festuca lanuginosa Scheele, Flora **1**: 63. 1844.

Festuca richardsoni Hook. Fl. Bor. Am. **2**: 250. 1840. Type from "the Arctic seacoast" of North America, collected by Richardson. Specimens in the Gray and Torrey Herbaria are probably duplicate types.

The Richardson specimens are quite identical with Arctic European specimens, and correspond to *F. rubra arenaria* forma *arctica* Hack. Mon. Fest. 140. Specimens from Port Clarence, Alaska, Doctor Yemans, August, 1884, are identical. Specimens collected on Unimak Island, Alaska, by Macoun (22801) are taller and agree with the ordinary European plant.

14. **Festuca occidentalis** Hook.

Festuca occidentalis Hook. Fl. Bor. Am. **2**: 249. 1840. "Plains and elevated grounds of the Columbia near the sea. Dr. Scouler. Douglas." Authentic specimens from Hooker are in the Gray Herbarium.

Festuca ovina polyphylla Vasey; Beal, Grasses N. A. **2**: 597. 1896. Type specimen in herbarium Michigan Agricultural College, collected in the Cascade Mountains, Oregon, by Howell, in 1885.

DESCRIPTION.

Densely tufted and perfectly glabrous up to the inflorescence; culms slender, shining, 50 to 80 cm. high, 2-jointed; leaf blades filiform-involute, numerous, bright green, soft, becoming longitudinally sulcate when dry, 5 to 20 cm. long, acute at the very apex; ligule very small, truncate; sheaths smooth, very long, but shorter than the internodes, in young plants often wholly concealing the stem; panicle loose, subsecund, flexuous, 8 to 20 cm. long, often somewhat drooping above; rays scabrous on the sharp angles, solitary or the lowest paired and very unequal; spikelets green, oblong, loosely 3 to 5-flowered, 6 to 10 mm. long, mostly on slender stalks, pale green, or rarely purplish; glumes unequal, variable, even on the same plant, usually sharply acute or acuminate, sometimes obtuse or obtusish, the lower 1-nerved, 2 to 2.5 mm. long, the upper 3-nerved, about one-half longer, both usually puberulent near the apex and margins; lemma oblong-lanceolate, rather thin in texture, 5 to 6.5 mm. long, scaberulous toward the apex, attenuate into a slender awn about as long; palea linear-lanceolate, acutish, scabrous on the nerves, the inflexed sides meeting in the middle when flattened; ovary hispidulous at apex. PLATE VIII.

This species has been generally misunderstood, principally owing to the character assigned to the glumes of being short, obtuse, and ciliate. The Gray Herbarium specimens agree perfectly with Hooker's characterization in this respect, as do some recent specimens, for example, E. C. Smith's 936, Seattle, Washington; Macoun's 85, Burrard Inlet, British Columbia, and Heller's 3932, Montesano, Washington. This character is, however, unreliable, most specimens having longer and usually acute glumes. It is a very different plant from the Japanese *Festuca pauciflora* Thunb. to which it was referred by Thurber. Thurber's description in the Botany of California applies not to Hooker's species, but to *Festuca subulata* Trin. (*F. jonesii* Vasey.)

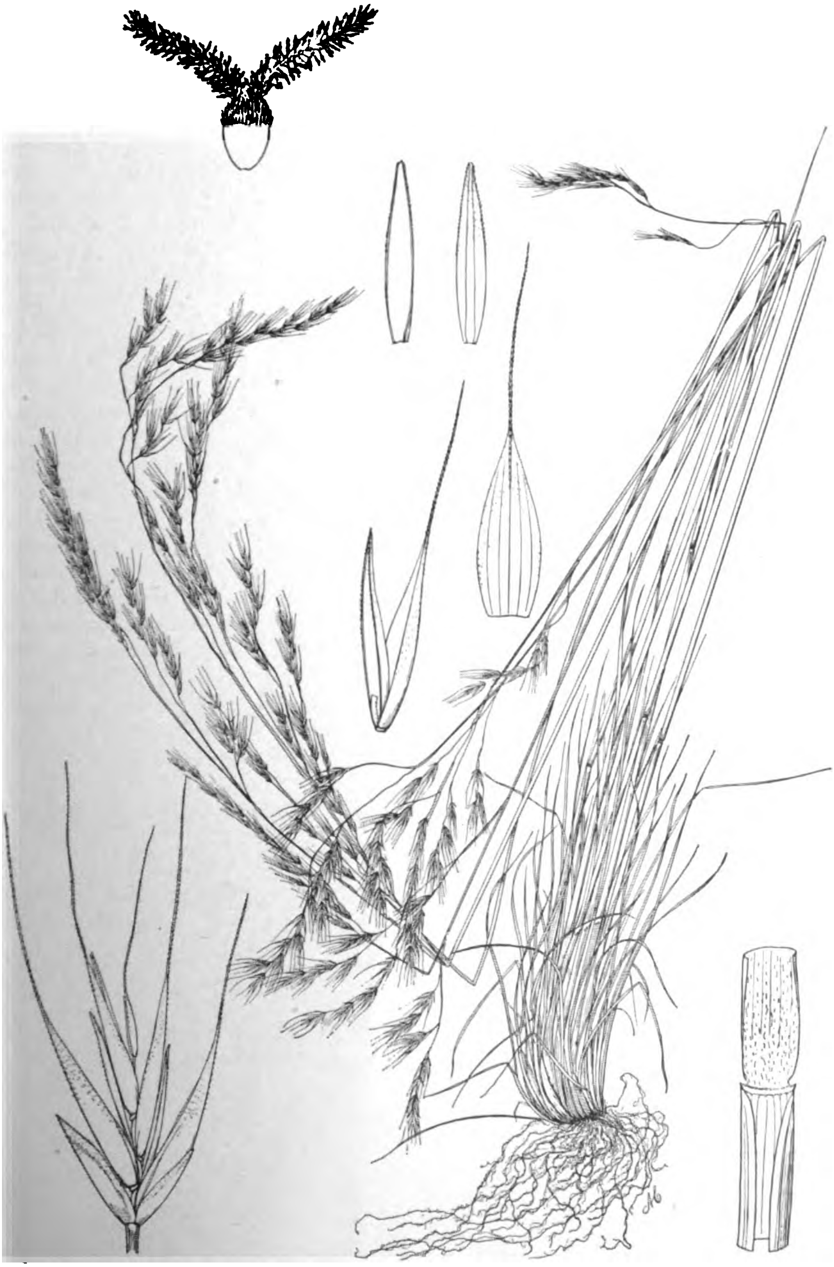
Festuca occidentalis is an abundant species in open woods from British Columbia to middle California, and eastward to Montana, Wyoming, and the Great Lakes. It is always densely tufted, never showing any trace of rootstocks.

In Beal's Grasses of North America the specimens referred to *Festuca rubra heterophylla* (Lam.) Hack., and to *F. rubra longiseta* (Hegetschw.) Hack. are all *F. occidentalis* Hook.

The following are representative specimens:

BRITISH COLUMBIA:
- Chilliwack Valley, *Macoun* 26115, 26112.
- Victoria, *Macoun* 171.
- Comox, *Macoun* 173.
- Yale, *Macoun* 88.

WASHINGTON:
- Blue Mountains, *Horner* 561.
- Cascade Mountains, *Vasey* in 1889.
- Olympia, *Henderson* 2198, 2177.
- Seattle, *Piper* 834.
- Mount Rainier, *Piper* 850.
- Nisqually Valley, *Allen* 50.
- Grays Harbor, *Lamb* 1128.



FESTUCA OCCIDENTALIS HOOK.

WASHINGTON—Continued.
Rock Creek, Spokane County, *Suksdorf* 1141.
Olympic Mountains, *Elmer* 1917.
Montesano, *Heller* 3932.

OREGON:
Without locality, *Hall* 641.
Portland, *Howell* 15.
Wallowa Mountains, *Cusick* 2211.
Blue Mountains, *Shear* 1682, 1809, 1676.

CALIFORNIA:
Mendocino County, *Davy* 6607.
Mount Shasta, *Brown* 373.
Marin County, *Palmer* 2044.
Long Valley, *Kellogg & Harford* 1116.
Without locality, *Bolander* 6704.
El Volcan, *Brandegee* 104.

IDAHO:
Cœur d'Alene Lake, *Sandberg, Heller, & MacDougal* 544.
Cedar Mountain, Latah County, *Piper* 3930, 1917.
Cedar Mountain, Latah County, *Henderson* 2835.

MONTANA:
Summit, *Griffiths & Lange* 209, 192.

WYOMING:
Nez Perces Creek, *Nelson* 6216.
Yellowstone Park, *Bolley* 1898.

MICHIGAN:
Keweenaw County, *Farwell* 531.
Thunder Bay, *Wheeler*, July 18, 1895.

EXPLANATION OF PLATE.—Drawn from 4908 *Piper*, Vancouver, Washington. Plant one-half natural size; ovary and stigmas enlarged ten times, other details five times.

15. **Festuca ovina** L.

Festuca ovina L. Sp. Pl. **1**: 73. 1753. "Habitat in Europae collibus apricis aridis vulgatissimum."

Festuca ovina vulgaris Koch, Syn. **2**: 812. 1837.

DESCRIPTION.

Densely tufted; culms erect, 3-jointed, mostly 15 to 60 cm. high, smooth or somewhat scabrous near the panicle; sheaths smooth, shorter than the internodes; ligule very short, 1 mm. or less; blades pale green, strongly involute, firm, narrow, cylindric, scabrous on the margins, the basal ones 5 to 12 cm. long, those of the culm often very short; panicle contracted after blooming, commonly 5 to 10 cm. long; rays ascending, scabrous on the angles; spikelets ovate or oblong, usually 5 to 7.5 mm. long, 3 to 6 or rarely 9-flowered, pale green, or sometimes purplish tinged; florets rather close; joints of the rachilla smooth; glumes unequal, linear-lanceolate, acute, the lower 1-nerved, about 2 mm. long, the upper 3-nerved, about 2.5 mm. long; lemma lanceolate, thick and firm, convex, obscurely 5-nerved, smooth or more or less scabrous, 3 to 3.5 mm. long, attenuate in a scabrous awn 1 mm. long or more.

This species in its typical form occurs native in North America in the Rocky Mountains from Alberta to New Mexico, in the Black Hills, and about the Great Lakes. Through cultivation it is more or less commonly introduced in many localities. The specimen referred by Beal, Grasses N. Am. **2**: 600, to *F. hystrix* Boiss. is true *F. ovina*.

Perhaps no other species of grass is so polymorphous as *Festuca ovina*, the Old World forms of which have been classified into numerous categories. The North American forms are far less numerous, and may be distinguished by the following key:

KEY TO THE SUBSPECIES OF FESTUCA OVINA.

- Leaf blades firm, cylindric or terete even when dried.
  - Lemmas awned.
    - Leaf blades capillary .3 to .6 mm. broad.
      - Plants 20 to 60 cm. high; panicle 2 to 12 cm. long.
        - Lemmas usually scabrous or pubescent .... *ovina.*
        - Lemmas hispidulous .... *ovina sciaphila.*
        - Lemmas foliaceous, the spikelets proliferous........ *ovina vivipara.*
      - Plants 12 to 30 cm. high; panicle 2 to 4 cm. long .... *ovina supina.*
    - Leaf blades broader 0.7 to 1 mm. broad, 7 nerved........ *ovina duriuscula.*
  - Lemmas awnless.................... *ovina capillata.*
- Leaf blades smooth, green, soft, becoming longitudinally sulcate in drying.
  - Culms 20 to 45 cm. high; sheaths closed only at base .... *ovina pseudovina.*
  - Culms 5 to 10 cm. high; sheaths closed their whole length or nearly. *ovina brachyphylla.*
- Leaf blades pale or glaucescent, firm, usually harshly scabrous.
  - Sheaths long-persistent on the innovations, becoming brown and papery. *ovina calligera.*
  - Sheaths not becoming brown and papery.
    - Awns long, nearly equaling the lemma; sheaths not becoming explanate at base.................... *ovina ingrata.*
    - Awns short, one-fifth to one-third as long as the lemma; sheaths becoming explanate at base .... *ovina arizonica.*

15a. **Festuca ovina sciaphila** (Schur) Asch. & Graebn.

Festuca sciaphila Schur, Enum. Pl. Transs. 787. 1866. "In Laubwäldern bei Hermannstadt. Schuler, Piatra-mare bei Kronstadt. 3,000′. Kalk."

Festuca ovina sciaphila Asch. & Graebn. Syn. Mitteleur. Fl. **2**: 468. 1900; op. cit. Index 41. 1903.

Festuca ovina hispidula Hack. Mon. Fest. 87. 1882. "Transsylvania (Kronstadt), Silesia (Breslau), Austria inf. (St. Pölten)."

The following specimens have been examined:

New York:
Ithaca, *Coville*, June 12, 1886.
Ontario:
Galt, *Herriott*, no. 21144.
British Columbia:
Esquimalt, *Macoun* 29732.

The last two are in the Herbarium of the Geological and Natural History Survey of Canada.

15b. **Festuca ovina vivipara** L.

Festuca ovina vivipara L. Sp. Pl. ed. 2. **1**: 108. 1762. "Habitat in Alpibus Lapponiae, Helvetiae, Scotiae."

Festuca vivipara Smith, Fl. Brit. **1**: 114. 1800. This occurs in North America from Greenland and Iceland to Labrador and Newfoundland. The plant of the White Mountains heretofore referred here is *F. rubra prolifera.*

15c. **Festuca ovina supina** (Schur) Hack.

Festuca supina Schur, Enum. Pl. Transs. 784. 1866. "Auf Felsen und Gerölle der Hochalpen: Fogaraser-Arpaser-Kerzesorer-Rodnaer Alpen, Glimmerschiefer; Kronstädter Alpen: Butsets, Königstein, Kalk, Hunyader Alpen, Retyezat. 6000′–7000′."

Festuca ovina supina Hack. Bot. Centralb. **8**: 405. 1881.

This subspecies ranges from Greenland southward to the White Mountains, and in the west occurs from British Columbia and Alberta south in the Cascades and Sierras to California, and in the Rockies to Arizona. Apparently it does not occur in Alaska.

This plant has been generally confused by American botanists with *F. ovina brachyphylla*, from which it is often separable with difficulty.

15d. **Festuca ovina duriuscula** (L.) Koch.

Festuca duriuscula L. Sp. Pl. **1**: 74. 1753. "Habitat in Europae pratis siccis."

Festuca ovina duriuscula Koch, Syn. 812. 1857.

Judging from herbarium material this subspecies is but sparingly introduced in America. Most specimens so named are *F. rubra*.

15e. **Festuca ovina capillata** (Lam.) Hack.

Festuca capillata Lam. Fl. Fr. **3**: 597. 1778. Type locality, France.

Festuca tenuifolia Sibth. Fl. Oxon. 44. 1794. Type locality, Oxford, England.

Festuca ovina capillata Hack. Bot. Centralb. **8**: 405. 1881.

This very distinct-appearing subspecies is introduced in many places in the eastern United States.

15f. **Festuca ovina pseudovina** Hack.

Festuca ovina pseudovina Hack. Bot. Centralb. **8**: 405. 1881. Hackel's name is proposed for the Austrian grass mistaken for true *F. ovina* L. by Host, Gram. Austr. **2**: *pl. 86*.

This subspecies occurs native in North America in the Rocky Mountains of Wyoming, Colorado, and Utah. Specimens from Clarke, Indiana, collected by Umbach, are probably introduced.

15g. **Festuca ovina brachyphylla** (Schultes).

Festuca brevifolia R. Br. App. Parry's Voy. Suppl. 289. 1824. Type from Melville Island. A duplicate in the Gray Herbarium.

Festuca brachyphylla Schultes, Mant. **3**: 646. 1827. Proposes new name on account of the older *F. brevifolia* Muhl. 1817.

Festuca ovina brevifolia Hack. Bot. Centralb. **8**: 406. 1881.

This subspecies ranges in North America from the Arctic regions southward to Labrador, and in the Rocky Mountains to Arizona, and recurs in the Sierras of California; apparently absent in the Cascades, but present in the Blue Mountains of Oregon.

15h. **Festuca ovina calligera** nom. nov.

Festuca amethystina asperrima Hack.; Beal, Grasses N. Am. **2**: 601. 1896, not *F. asperrima* Link, Enum. **2**: 270. 1822. Type in the National Herbarium, collected in Arizona by Rusby (no. 901).

Plants densely tufted, pale green, 15 to 50 cm. high; stems covered at base by the brown scarious persistent sheaths; leaf-blades filiform, longitudinally sulcate, scabrous, 5 to 15 cm. long, each bearing at its junction with the sheath a small callus on each side; lemma awned; palea bidentate.

The following specimens belong here:

UTAH:
- Aquarius Plateau, *L. F. Ward* 502, altitude 3,500 m.
- Brigham Peak, *Jones* 5955, altitude 3,700 m.

ARIZONA:
- Mount Agassiz, *Lemmon*, September, 1884.
- White Mountains, *Griffiths* 5338, 5243.
- Hart's Little Spring, *Toumey*, July 13, 1892.
- San Francisco Peaks, *Leiberg* 5957, altitude 2,800 m.
- Without locality, *Rusby* 901.

CALIFORNIA:
- Plumas County, *Lemmon* 4653.

15i. **Festuca ovina ingrata** Hack.

Festuca ovina ingrata Hack.; Beal, Grasses N. Am. **2**: 598. 1896. Type specimen in the National Herbarium, collected by Howell in Oregon.

Festuca ovina columbiana Beal, op. cit. 599. Type in Herbarium Michigan Agricultural College, published as from Pullman, Washington, but really collected in the Blue Mountains of Columbia County, Washington, by Lake and Hull.

Festuca ovina oregona Hack.; Beal, op. cit. 599, not *Festuca oregona* Vasey. Type in the National Herbarium, collected by Cusick in Oregon (no. 753).

Festuca idahoensis Elmer, Bot. Gaz. **36**: 53. 1903. Type specimens from Smiths Valley, Shoshone County, Idaho, collected by Abrams. We have examined a duplicate in Elmer's herbarium. The leaves of this specimen are unusually smooth.

This is the "blue bunch grass" of stockmen, and is an important range grass. It occurs from British Columbia and Alberta south to California and Colorado.

It is the American analogue of the Old World *Festuca ovina valesiaca* (Schleich.) Koch, and has sometimes been referred to the European *F. ovina sulcata* Hack.

The following are representative collections:

WASHINGTON:
- Pullman, *Elmer* 299, 826.
- Falcon Valley, *Suksdorf* 1142.
- Clark Springs, *Kreager* 41, 68.
- Mount Carlton, *Kreager* 241.

OREGON:
- Grizzly Butte, *Leiberg* 276.
- Without locality, *Cusick* 2507.

CALIFORNIA:
- Plumas County, *Lemmon* 4653.
- Highland Springs, *Davy* 6647.

ALBERTA:
- Sheep Mountains, *Macoun* 13148.

BRITISH COLUMBIA:
- Deer Park, *Macoun* 52.

MONTANA:
- Spanish Basin, *Rydberg & Bessey* 3676.
- Lima, *Rydberg* 2070; *Shear* 320.

IDAHO:
- Beaver Canyon, *Rydberg* 2061; *Shear* 305.
- Little Potlatch River, *Sandberg, Heller, & MacDougal* 451.
- Viola, *Sandberg, Heller, & MacDougal* 504.
- Lake Waha, *Heller* 3318, 3288.

WYOMING:
  Nash Fork, *Nelson* 7746.
UTAH:
  Crazy Womans Creek, *Williams* 2751.
COLORADO:
  Chicken Creek, *Tracy*, *Earl*, & *Baker* 344.
  Routt County, *Crandall* 539.
  Veta Pass, *Shear* 824.
  South Park, *Wolf* 295a.
NEVADA:
  Summit Lake, *Griffiths* & *Morris* 303.
  Pine Forest Mountains, *Griffiths* & *Morris* 215.

15j. **Festuca ovina arizonica** (Vasey) Hack.

Festuca arizonica Vasey, Contr. Nat. Herb. **1**: 277. 1893. Type specimen in the National Herbarium, collected by S. M. Tracy near Flagstaff, Arizona (no. 118).

Festuca ovina arizonica Hack.; Beal, Grasses N. Am. **2**: 598. 1896. Reduces the above to subspecific rank.

Festuca vaseyana Hack.; Beal, op. cit. 601. Type collected at Veta Pass, Colorado, by Dr. George Vasey in 1884.

Festuca scabrella vaseyana Hack.; Beal, op. cit. 605. Type from "Colorado (Veta Pass), Vasey, at an altitude of 9,300 feet."

The type specimens of the last two were in Professor Scribner's herbarium, according to Doctor Beal. The National Herbarium specimens show that Doctor Vasey collected both *arizonica* and *ingrata* at Veta Pass, but Doctor Beal's descriptions were certainly based on the *arizonica* specimens in the case of *Festuca scabrella vaseyana* and probably so in the case of *Festuca vaseyana*.

Festuca ovina arizonica occurs in Southern Colorado, Arizona, and New Mexico. A specimen from Oregon, Hoover Creek, Gilliam County (*Leiberg* 137), seems also referable here.

16. **Festuca rigescens** (Presl) Kunth.

Diplachne rigescens Presl, Reliq. Haenk. **1**: 260. 1830. "Hab. in montanis Peruviae huanocensibus." Type probably in Presl's herbarium in the University of Prague; a duplicate in Bernhardi's herbarium, now in the possession of the Missouri Botanical Gardens.

Festuca rigescens Kunth, Enum. Pl. **1**: 403. 1833. Transfers the above to Festuca. The only North American specimen we have seen was collected by S. M. Tracy "in open pine woods, 4 miles northeast of Flagstaff, Arizona, June, 1887."

DESCRIPTION.

Densely tufted, smooth and glabrous up to the inflorescence; culms 2-jointed, hard and polished, rigid, 30 to 50 cm. high; sheaths smooth, shorter than the internodes, the basal ones much broadened and somewhat explanate; ligule nearly obsolete, ciliate; blades involute, cylindric, rigid, erect, smooth, pungent at the apex, 8 to 12 cm. long, 1 to 2 mm. in diameter; panicle narrow, erect, 5 to 10 cm. long; rays few, solitary, erect, sparingly branched, angled, nearly smooth; spikelets rather closely 3-flowered, 6 to 7 mm. long; joints of the rachilla cylindric, smooth; glumes thick and firm, the lower 1-nerved, acute, 2 mm. long, the upper 3-nerved, a little longer, both scabrous toward the tips; lemma ovate, thick, convex, somewhat carinate toward the acuminate apex, awnless or very short-awned, scabrous near the tip, 4 to 4.5 mm. long, 5-nerved, the lateral nerves disappearing above the middle; palea as long as the lemma, obtuse, the nerves hispidulous.

This plant is easily distinguishable from any of the North American forms of *F. ovina*. Some European subspecies, however, as *F. ovina vaginata* and *F. ovina psammophila*, have, like the American plant, the combination of rigid leaves and awnless lemmas. It may therefore be necessary to reduce our plant to subspecific rank.

17 **Festuca viridula** Vasey.

Festuca viridula Vasey, Ill. N. A. Grasses **2**: 93. 1893. Type in the National Herbarium, collected in California by Bolander.

In the original description Doctor Vasey gives "California" as the locality for the species. At that time he had before him, from California, two specimens from Bolander and one from Lemmon, all of which he labelled *Festuca viridula* in his own handwriting, adding in the case of one Bolander specimen a mark of doubt. Inasmuch as part at least of the accompanying illustration is drawn from a Bolander specimen, the one so marked without mark of doubt is selected as type. This specimen was received from the Thurber herbarium, labelled *Festuca gracillima* Hook., and is doubtless the basis of Doctor Vasey's statement to the effect that Thurber was in error in identifying the species in the Botany of California as *Festuca gracillima* Hook.

In a later publication[a] Doctor Vasey cites a specimen collected by Suksdorf on Mount Adams, Washington, as the type, but this statement is incompatible with the original description.

Bolander's specimens probably all came from Summit Station, in the Sierras. At least the second specimen above mentioned is ticketed as being from that place.

DESCRIPTION.

Densely tufted, the coarse roots much interwoven, and the tufts, therefore, difficult to separate; culms erect, smooth, shiny, 3-jointed, 50 to 100 cm. high; sheaths smooth, striate, shorter than the internodes; ligule very short, truncate; blades erect, narrowly linear, acute at the apex, soft, scaberulous above, strictly 7-nerved, the basal ones usually involute, 10 to 30 cm. long, those of the culm shorter, flat or loosely involute; panicle loose and open, suberect, 10 to 15 cm. long; rays faintly angled, swollen at base, scabrous, the upper solitary, the lower in pairs and 5 to 8 cm. long, branched and spikelet-bearing near the tip; spikelets oblong, 3 to 6-flowered, 10 to 12 mm. long, pale green or more commonly purple; joints of the rachilla scabrous, cylindric, 1 to 2 mm. long; glumes membranous, smooth or nearly so, the lower lanceolate, 1-nerved, about 2.5 mm. long, the upper ovate, subacute, 3-nerved, scarious-margined; lemma firm, membranaceous, keeled toward the apex, 5-nerved, oblong-lanceolate, acute, or somewhat mucronate, often somewhat denticulate near the apex, smooth or nearly so, shining rather than dull, 6 to 7 mm. long; palea about equaling the lemma, obtuse, the nerves ciliate.

The species is common in subalpine meadows in Washington, Oregon, and Idaho, and ranges south in the Sierras to middle California.

18. **Festuca howellii** Hack.

Festuca howellii Hack.; Beal, Grasses N. Am. **2**: 591. 1896. Type in Herbarium Michigan Agricultural College, collected by Thomas Howell, in the mountains at the head of Deer Creek, Josephine County, Oregon, July 5, 1887; a duplicate in the National Herbarium. No other specimens than those of the type collection are known.

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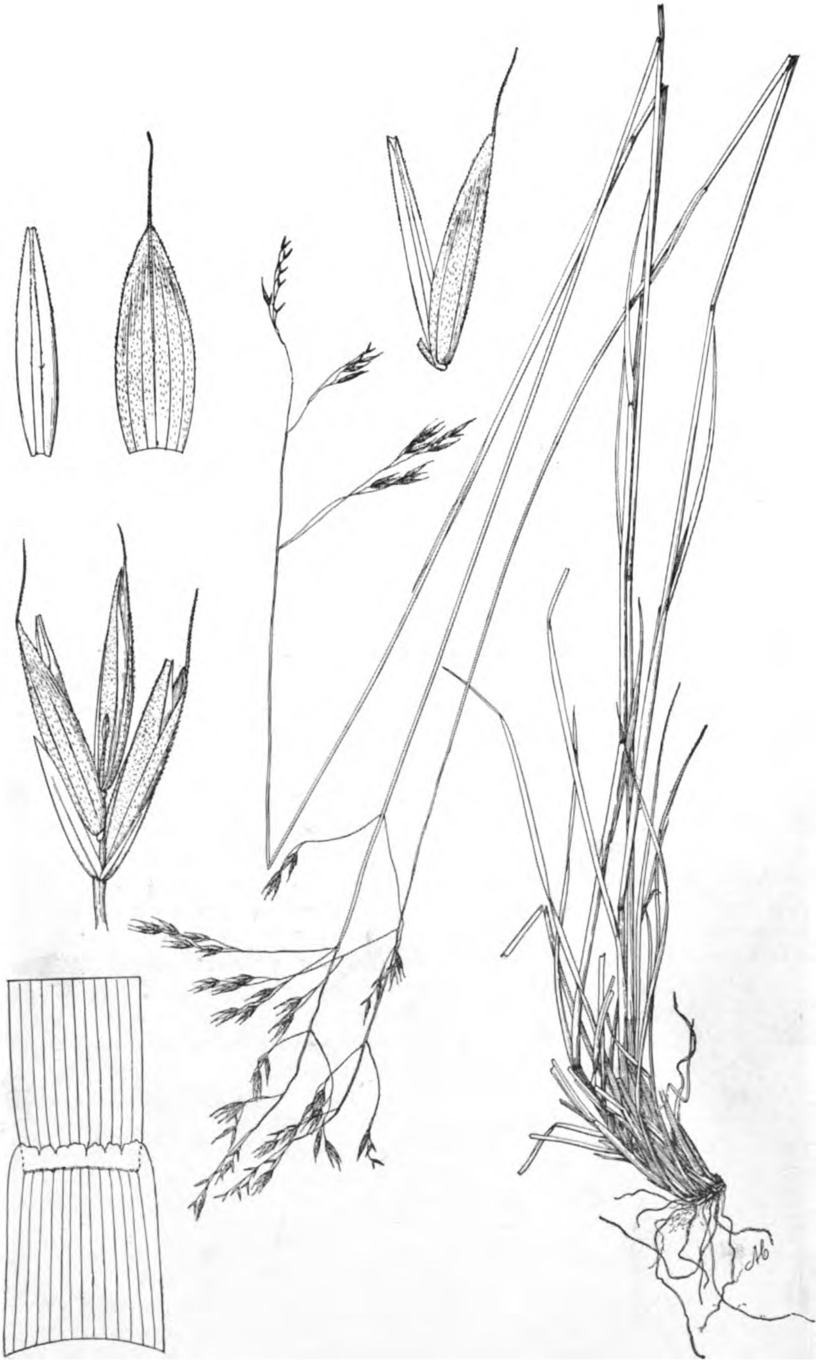
[a] Contr. Nat. Herb. **1**: 279.



FESTUCA HOWELLII VASEY.

DESCRIPTION.

Densely tufted, with coarse matted roots; culms erect or geniculate at base, 3-jointed, 60 to 70 cm. high; sheaths smooth, mostly shorter than the internodes; ligule very short; blades loosely involute, shining, narrowly linear, scabrid above, 8 to 15 cm. long, about 4 mm. wide, acute at apex; panicle loose and open, 8 to 10 cm. long; lower rays in pairs, the upper solitary, each pulvillus-bearing at base, subterete, scaberulous, naked below; spikelets oblong, 8 to 12 mm. long, 4 or 5-flowered, purple-tinged; joints of the rachilla cylindric, scaberulous, 1 mm. long; glumes lanceolate, glabrous or nearly so, the lower 1-nerved, 2 to 3 mm. long, the upper 3-nerved, about 4 mm. long; lemma membranaceous, linear-lanceolate, strongly 5-nerved, appressed-hispidulous, 6 mm. long, attenuate into a straight scabrous awn about 2 mm. long; palea obtuse, about equaling the lemma, somewhat scabrous. PLATE IX.

EXPLANATION OF PLATE.—Drawn from duplicate type from 248 *Howell*, collected in Deer Creek Mountains, Oregon. Plant one-half natural size; details magnified five times.

19. **Festuca altaica** Trin.

Festuca altaica Trin. in Ledeb. Fl. Alt. **1**: 109. 1829. "In summa alpe ad fontem fl. Acjulac rarissima."

Festuca scabrella Torr.; Hook. Fl. Bor. Am. **2**: 252. 1840. Type probably at the British Museum, collected in the Rocky Mountains by Drummond. Duplicates of the same are in the Torrey Herbarium and in the Gray Herbarium.

The Drummond specimens are most nearly matched in recent collections by plants collected on Mount Albert, Gaspé, by Allen in 1881 and 1882. No recent collection seems to have been made near the type locality. Hooker's figure shows a panicle with ascending rays, but the Gray Herbarium specimens show spreading rays as in most northern material. The nearly smooth and loosely involute leaves are likewise characters which ally the plant to *altaica* proper, rather than to the more scabrous plant of the United States, which, however, it resembles in its rather dull spikelets.

DESCRIPTION.

Densely tufted, with numerous basal leaves; culms erect, smooth or nearly so, 2-jointed, 30 to 90 cm. high; sheaths striate, smooth or the uppermost scabrous; ligule very short; blades mostly involute, smooth or scabrous beneath, especially toward the apex, hispidulous above; panicle ample, loose and open, erect, 10 to 20 cm. long; rays mostly in pairs in about 6 verticels, slender, flexuous, naked below the middle, branched above, pulvillate-thickened at base; spikelets broadly oblong, 3 to 5-flowered, 12 to 15 mm. long, yellowish-green, or more commonly coppery or purple; florets close, nearly parallel to the rachilla; joints of the rachilla cylindric or slightly clavate, scabrous, 2 to 3 mm. long; glumes smooth, or scabrous near the apex, the lower oblong-lanceolate, obtusish, 1-nerved, 6 to 7 mm. long, the upper ovate-lanceolate, acute, 3-nerved, 8 to 9 mm. long; lemma lanceolate-ovate, attenuate-acute, 5-nerved, finely and densely scabrous, somewhat shiny, 10 to 12 mm. long, firm-membranaceous; palea oblong-lanceolate, notched at apex, the inflexed sides more than half as broad as the internerve, the nerves hispidulous.

The species ranges through Siberia, and in North America occurs in Alaska, Yukon, and on Mount Albert, Quebec.

20. **Festuca hallii** (Vasey).

Melica hallii Vasey, Bot. Gaz. **6**: 296. 1881. Type specimens in the National Herbarium, collected in the Rocky Mountains, latitude 39° to 41°, by *Hall & Harbour* (no. 621), in 1862. These specimens have a narrow strict panicle, and are evidently from high altitudes.

Festuca scabrella major Vasey, Contr. Nat. Herb. **1**: 278. 1893. Type specimen in the National Herbarium, collected in Spokane County, Washington, by Suksdorf (no. 118), June 18, 1884. This is a much larger plant than the type of *Melica hallii*, with a larger and looser panicle. Most of the United States material is quite intermediate between the two.

Festuca campestris Rydb. Mem. N. Y. Bot. Gard. **1**: 57. 1900. Proposes a new name for the above, on account of the older *Festuca nutans major* Vasey, which latter, however, is a technically unpublished name.

DESCRIPTION.

Densely tufted, the broad leaves numerous; culms erect, 2-jointed, smooth or scabrous, 30 to 90 cm. high; upper sheaths scabrous, closely enveloping the stem, the lower smooth, exceeding the internodes, enlarged and somewhat explanate at base; ligule small; blades hard and strongly involute, pale or glaucous, 10 to 30 or even 50 cm. long, pungently acute, usually very scabrous, the basal ones deciduous from the persisting sheaths; panicle narrow and rather close, often subsecund, 3 to 15 cm. long, rays solitary or in pairs, very scabrous, usually ascending or appressed, spikelet-bearing near the end, the longest less than half the panicle, often pulvillate-thickened at base; spikelets oblong 8 to 12 mm. long, 4 to 6-flowered; glumes unequal, smooth, or scabrous near the apex, the lower lanceolate, 1-nerved, 7 to 8 mm. long, the upper ovate-lanceolate, 3-nerved, 8 to 9 mm. long; lemma firm, dull, 5-nerved, keeled near the apex, densely and finely scabrous, 8 to 10 mm. long, acute or rather abruptly mucronate or short-awned; palea about as long as the lemma, notched at the apex, pubescent on the nerves, the inflexed sides more than half as broad as the internerve.

Festuca hallii ranges from British Columbia to North Dakota, Colorado, and Washington. We would also refer here two specimens from Dawson, Yukon, namely, R. S. Williams, July 13, 1899, and John McClean, no. 84.

The species as thus delimited includes rather diverse-looking material, but in the light of the specimens at hand we can suggest no better disposition. There are good reasons, indeed, for considering it a mere subspecies of *F. altaica*.

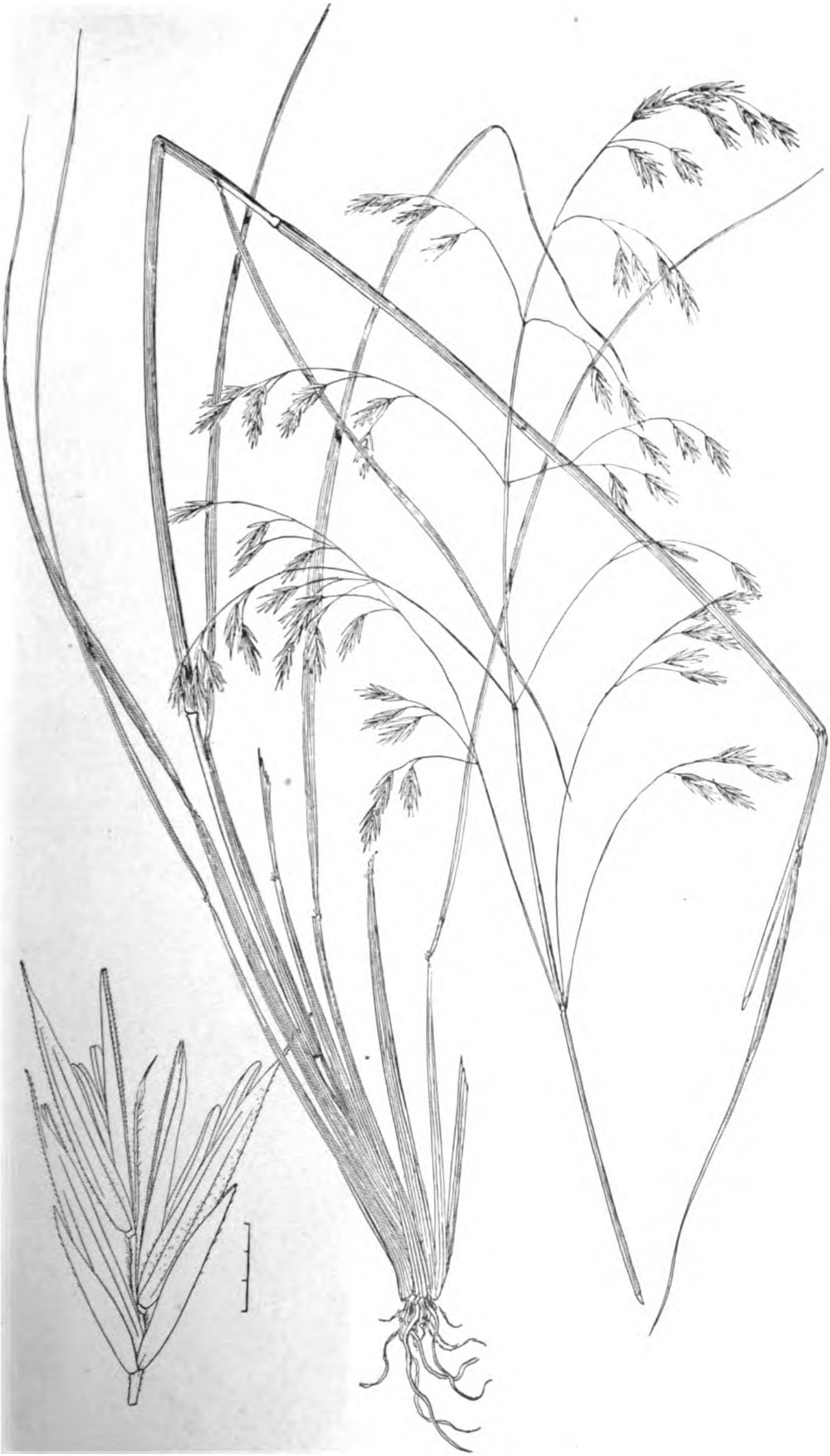
21. **Festuca aristulata** (Torr.) Shear ms.

Bromus kalmii aristulatus Torr. Pac. R. Rep. **4**: 157. 1856. Type in the National Herbarium, collected on Mark West Creek, California, April 30, 1854, by Dr. J. M. Bigelow.

Festuca californica Vasey, Contr. Nat. Herb. **1**: 277. 1893. Type in the National Herbarium, collected on hills about Oakland, California, by Bolander (no. 1505) in 1862.

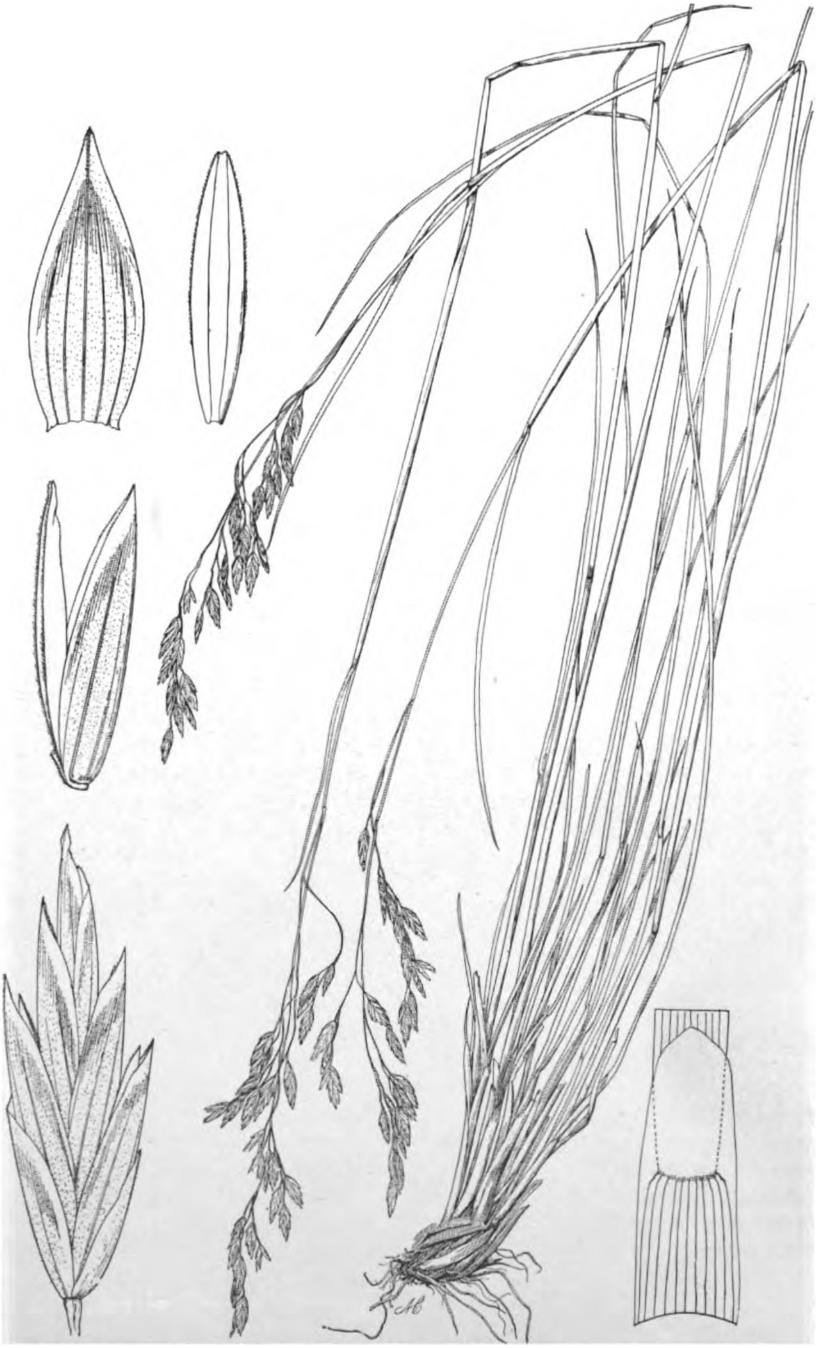
DESCRIPTION.

A coarse tufted grass with numerous basal leaves; culms erect, stout, 2-jointed, about 60 to 120 cm. high, striate, scabrous; sheaths somewhat scabrous, often purplish, the lower long-persisting, the collar and auricles white-pilose; ligule ciliate, very short; blades flat or involute, hard, densely beset with minute scarcely rough granulations, 8 to 40 cm. long, acute at the apex, 2 to 5 mm. broad, inclined to be deciduous from the sheaths; panicle ample, usually loose, 10 to 30 cm. long; rays slender, usually elongated, terete or angled, scabrous, in about 4 whorls of 2 to 3 each, pulvillate-thickened basally; spikelets 8 to 18 mm. long, broadly oblong, compressed, mostly 5-flowered; joints of the rachilla cylindric, scabrous, 2 to 3 mm. long; glumes oblong-lanceolate, firm, smooth, except the scabrous midnerve, the lower 1-nerved, about 5 to 7 mm. long, the upper 3-nerved, 6 to 8 mm. long; lemma 8 to 10 mm. long, lanceolate, convex, firm, 5-nerved, finely and evenly scabrous, acuminate or short-



FESTUCA ARISTULATA (TORR.) SHEAR.

PLATE XI.



FESTUCA THURBERI VASEY.

awned; palea about as long as the lemma, notched at apex, the nerves hispidulous, the inflexed sides one-third as broad as the internerve. (Plate X.)

This species ranges from middle California northward into Oregon, but only west of the Sierras and Cascades.

EXPLANATION OF PLATE.—Drawn from Howell's no. 26 from Oregon and Bolander's California specimens. Plant natural size; spikelet magnified five times.

21a. **Festuca aristulata parishi** subsp. nov.

Sheaths and the lower part of the stem covered with short retrorse pubescence; leaf blades short, 10 to 25 cm. long.

Mill Creek Falls, San Bernardino Mountains, California, collected by S. B. Parish (no. 5036, type), June 20, 1901, and no. 2490, July 4, 1892.

22. **Festuca thurberi** Vasey.

Festuca thurberi Vasey in Rothrock, Prel. Rep. Botany Cent. Colo. 56. 1874. Type in the National Herbarium, collected by John Wolf (no. 1154) in South Park, Colorado.

Poa festucoides M. E. Jones, Proc. Cal. Acad. II. **5**: 724. 1895. Type from Mount Ellen, Henry Mountains, Utah. A duplicate in the National Herbarium.

Poa kaibensis M. E. Jones, Erythea **4**: 36. 1896. Proposes a new name for the above on account of the older *Poa festucoides* Lam.

DESCRIPTION.

Densely tufted with numerous narrow basal leaves; culms erect, hard, scabrous or smooth, 60 to 90 cm. high, 3-jointed; sheaths striate, usually scabrous, shorter than the internodes; ligules scarious, often lacerate, 2 to 4 mm. long, decurrent; blades closely involute, narrowly linear, 6 to 20 cm. long, acute at apex, usually harshly scabrous; panicle 10 to 15 cm. long, loose, slightly drooping; rays solitary, occasionally in twos or threes, scabrous on the angles, spreading or ascending, commonly pulvillate at base, the longest half to two-thirds as long as the panicle, spikelet-bearing only above the middle; spikelets lanceolate, acute, 3 to 6-flowered, 8 to 12 mm. long; joints of the rachilla cylindric, 1 to 1.5 mm. long, scabrous or nearly smooth; glumes membranaceous, smooth or scabrous on the keels, subequal, the lower 1-nerved, 2 mm. long, acute, the upper 3-nerved, 2.5 mm. long, obtusish; lemma elliptic-lanceolate, faintly 5-nerved, convex, rather firm in texture, finely scabrous near the margins or glabrous, cuspidate-acuminate; palea nearly equaling the lemma, oblong, obtuse, the nerves scabrous, the inflexed sides half as broad as the internerve. (PLATE XI.)

Colorado, Wyoming, and Utah.

EXPLANATION OF PLATE.—Drawn from specimens collected by Pammel above Beaver Camp, Colorado, July 3, 1896. Plant one-half natural size; details enlarged five times.

23. **Festuca elatior** L.

Festuca elatior L. Sp. Pl. **1**: 75. 1753. "Habitat in Europae pratis fertillissimis."

Festuca pratensis Hudson, Fl. Angl. 37. 1762. Type locality, England.

Festuca poaeoides Michx. Fl. Bor. Am. **1**: 67. 1803. "Hab. ad ripas maritimas fluminis S. Laurentii." A fragment of the type is in the Torrey Herbarium.

Festuca poaeoides americana Pers. Syn. **1**: 94. 1805. Based on the preceding.

Festuca americana F. G. Dietr. Vollst. Lex. Gaertn. **3**: 332. Based on the preceding.

DESCRIPTION.

Loosely tufted, often with short creeping rootstocks; culms smooth, 50 to 120 cm. high, smooth and glabrous, 3 or 4-jointed, erect or geniculate only at the very base; sheaths shorter than the internodes; ligule nearly obsolete; blades 10 to 60 cm. long, 4 to 8 mm. wide, flat, rather firm, smooth beneath, scabrous above, auriculate at base; panicle erect, 10 to 20 cm. long, contracted after blooming, varying from nearly simple to much branched; rays in 3 to 6 sets, rather short, scabrous on the angles, spikelet-bearing nearly to the base; spikelets oblong or lanceolate, 3 to 13, usually 6 or 8-flowered, 9 to 11 mm. long, pale green or more or less purplish; joints of the rachilla smooth, 1 to 1.5 mm. long; glumes lanceolate, the lower 1 to 3-nerved, about 3 mm. long, the upper 3 to 5-nerved, about 4 mm. long; lemma oblong-lanceolate, coriaceous, faintly 5-nerved, 5 to 7 mm. long, scabrid toward the apex, the scarious apex acutish or rarely short-awned; palea about equaling the lemma, oblong, slightly notched at apex, the nerves scabrous, the inflexed sides one-third as broad as the internerve.

Cultivated and more or less established throughout the United States and southern Canada.

23a. **Festuca elatior arundinacea** (Schreb.) Celak.

Festuca arundinacea Schreb. Spic. Fl. Lips. 57. 1771.

Festuca elatior arundinacea Celak. Prod. Fl. Böhm. 51. 1869..

This subspecies is rather sparingly introduced. It is larger and coarser than *F. elatior*, and is conveniently distinguishable by its firmer thicker leaves, the nerves of which are prominent on both surfaces, while in *F. elatior* the nerves are prominent only above.

24. **Festuca obtusa** Spreng.

Festuca nutans Spreng. Fl. Hal. Mant. 34. 1807. "E. Pennsylvania, Muhlenb." Not *Festuca nutans* Moench, Meth. 191. 1794.

Festuca obtusa Spreng. loc. cit. "E. Pennsylvania, Muhlenb." In Muhlenberg's Herbarium in the Philadelphia Academy of Sciences are specimens labeled *Festuca nutans*, and *Festuca sylvatica obtusa*. Apparently both these are herbarium names of Muhlenberg, which were first published by Sprengel. Both these specimens are clearly referable to the common eastern plant which has so long gone under the name of *Festuca nutans*.

Festuca nutans palustris Muhl. Gram. 166. 1817. From Muhlenberg's brief description this is merely a form of *F. obtusa*. It can scarcely be *Festuca shortii* to which Wood[a] referred it. There is nothing so labeled in Muhlenberg's Herbarium.

Poa nutans Link, Enum. 1: 86. 1821. Based on *Festuca nutans* Spreng.

DESCRIPTION.

Culms erect, 40 to 120 cm. high, glabrous or sometimes pubescent, 3 or 4-jointed; sheaths striate, shorter than the internodes, glabrous or pubescent; ligule very short; blades dark green, flat, 10 to 30 cm. long, 4 to 7 mm. wide, smooth or scabrous beneath, paler and scabrous or sometimes puberulent above, acute, auriculate at base; panicle very loose, 10 to 20 cm. long, often more or less secund, erect or but little nodding; rays in 3 to 5 sets, mostly in twos, pulvillate at base, scabrous on the prominent angles, sparingly branched and bearing a few spikelets near the end, at first erect, then spreading; spikelets pale green, lanceolate, 3 to 5-flowered, 5 to 7 mm. long; joints of the rachilla cylindric, glabrous, about 5 mm. long; glumes rather firm, scabrid on the nerves, the lower 1-nerved, about 3 mm. long, the upper 3-nerved, about 4 mm. long; lemma coriaceous, smooth, convex, oblong-ovate, acute or acutish, 4 mm. long, the narrow margin hyaline, obscurely 5-nerved, the nerves very obscure; palea firm, equaling the lemma, acute.

Vermont, Ontario, and Minnesota to Georgia and Texas.

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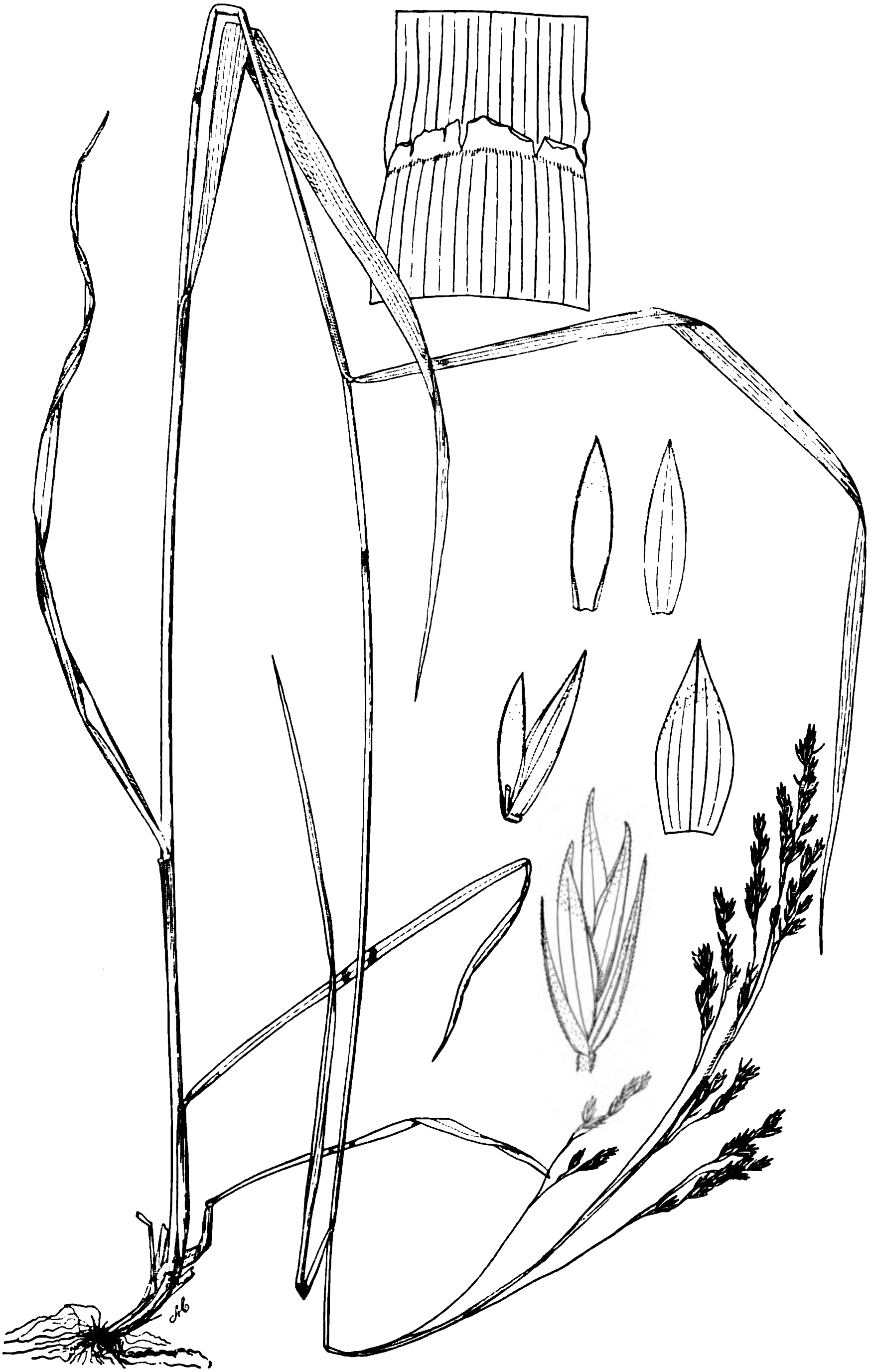
[a] Bot. & Flor. 399. 1873.



FESTUCA JOHNSONI VASEY.

25. **Festuca shortii** Kunth.

Festuca shortii Kunth; Wood, Class-book 794. 1861. No locality cited under the original very brief description, but a specimen in Short's herbarium in the Philadelphia Academy of Sciences bears the legend, "Barrens of Meade County, Kentucky." The type of Wood is probably in his herbarium preserved in the New York College of Pharmacy Herbarium.

Festuca nutans shortii Beal, Grasses N. Am. **2**: 589. 1896. Reduces above to subspecific rank.

Festuca nutans major Vasey; Beal, l. c., as synonym.

DESCRIPTION.

Culms 60 to 120 cm. high, erect, glabrous, smooth, 3-jointed; sheaths smooth or striate, glabrous, much shorter than the internodes; ligule very short; blades firm, flat, or loosely involute, 10 to 40 cm. long, 3 to 7 mm. broad, smooth or nearly so beneath, scabrous above, auriculate at base; panicle erect, 10 to 20 cm. long, bearing many spikelets; rays in 3 to 5 sets, mostly in twos, ascending or spreading, scabrous on the angles, spikelet-bearing above the middle; spikelets pale green, oblong-lanceolate, 5 to 7 mm. long, 3 to 6-flowered; joints of the rachilla, cylindric, smooth; glumes firm, scabrous on the nerves above, the lower 1-nerved, 4 mm. long, the upper 3-nerved, 5 mm. long; lemma oblong, coriaceous, smooth, obtusish, obscurely 5-nerved, 4 to 4.5 mm. long; palea firm, smooth, acute, about equaling the lemma.

This species ranges from Illinois and Iowa to Georgia and Texas.

26. **Festuca versuta** Beal.

Festuca texana Vasey, Bull. Torr. Club **13**: 119. 1886. Type in the National Herbarium, collected by J. Reverchon (no. 1618), "shades, upper Llano."

Festuca versuta Beal, Grasses N. Am. **2**: 589. 1896. Proposes a new name on account of the older *F. texana* Steud. Syn. Pl. Glum. 310. 1855.

Known only from Texas, there collected by Buckley and by Reverchon.

DESCRIPTION.

Stems erect, glabrous or somewhat glaucous, nearly concealed by the sheaths, about 80 cm. high, 3-jointed; sheaths striate, smooth; ligule very short; blades firm, flat, 20 to 25 cm. long, 4 to 6 mm. wide, auriculate at base, nearly smooth beneath, scabrous above; panicle loose, erect, 15 to 18 cm. long, nearly as broad; rays in 3 or 4 sets, slender, pulvillate at base and spreading, scabrous on the angles, bearing a few branchlets near the tips; spikelets oblong-ovate, glaucous, 3 to 5-flowered, 8 to 11 mm. long; joints of the rachilla cylindric, somewhat scabrous; glumes nearly glabrous, subequal, the lower 1-nerved, 5 mm. long, the upper 3-nerved, 6 mm. long; lemma oblong-lanceolate, acute or apparently acuminate, coriaceous, smooth or nearly so, glaucous, faintly 5-nerved, 6 to 7 mm. long; palea firm, acute, about equaling the lemma.

27. **Festuca johnsoni** (Vasey).

Festuca nutans johnsoni Vasey, Contr. Nat. Herb. **2**: 548. 1894. Type in the National Herbarium, collected at Harrison City, Tex., in 1886, by Mr. Johnson. No other specimens have been seen.

DESCRIPTION.

Culms stout, erect, smooth, nearly concealed by the sheaths, about 80 cm. high; sheaths striate, sparsely puberulent; ligule very short; blades flat, rather thick, acuminate, 20 to 30 cm. long, 6 to 10 mm. wide, scabrous on both sides, auriculate at base; panicle loose, erect, 10 to 25 cm. long; rays in 3 to 5 sets, mostly in twos, slender, scabrous on the angles, flexuous, ascending, sparingly branched, spikelet-bearing above the middle, scarcely pulvillate at base; spikelets green, 2 or 3-flowered, 5 to 7 mm. long; joints of the rachilla short, smooth; glumes firm, scabrous all over, the lower 1-nerved, 4 to 5 mm. long, the upper 3-nerved, 5 to 6 mm. long; lemma lanceolate-oblong, acute or apparently acuminate, 5-nerved, coriaceous, smooth except the scabrid apex, about 5 mm. long; palea nearly equaling the lemma, firm, acute. (PLATE XII.)

EXPLANATION OF PLATE.—Drawn from type specimen. Plant one-half natural size; details enlarged five diameters.

28. **Festuca subuliflora** Scribner.

Festuca subuliflora Scribner in Macoun, Cat. Can. Pl. **5**: 396. 1890. Type collected at Goldstream, Vancouver Island, by Macoun (no. 7). It was in the herbarium of Professor Scribner, since destroyed. A duplicate in the herbarium of the Geological and Natural History Survey of Canada has been examined.

Festuca ambigua Vasey, Contr. Nat. Herb. **1**: 277. 1893. Type in the National Herbarium, collected by Thos. Howell in Oregon in 1881.

Festuca denticulata Beal, Grasses N. Am. **2**: 589. 1896. Changes name of above on account of the earlier *Festuca ambigua* Le Gall.[a]

DESCRIPTION.

Culms erect, rather slender, striate, glabrous, 60 to 90 cm. high, 3 or 4-jointed; basal leaves few, those of the culms 3 or 4; sheaths shorter than the internodes, striate, sparsely hispidulous; ligule very short, ciliate; blades green, rather soft, flat or loosely involute, glabrous beneath, hirsutulous above, 10 to 20 cm. long, 3 to 6 mm. broad, acute at the apex; panicle very loose, flexuous, somewhat drooping, 10 to 20 cm. long; rays slender, solitary or rarely in twos, scabrous on the angles, pulvillate at base, the longest about half as long as the panicle, naked below the middle; spikelets pale green or purplish, loosely 3 or 4-flowered, 8 to 12 mm. long; joints of the rachilla hirsute; glumes subulate, glabrous, each 1-nerved, the lower about 3 mm., the upper 4 mm. long; lemma lanceolate, 5-nerved, scabrous toward the apex, keeled half way or more, 6 to 8 mm. long, tipped with a more or less flexuous awn 10 to 15 mm. long, abruptly narrowed at base into a hispid tubular structure encircling the rachilla, which apparently disarticulates halfway between the florets; palea lanceolate, as long as the lemma, the scabrous nerves uniting in the acuminate apex, the inflexed sides one-third as broad as the internerve. (PLATE XIII.)

A very remarkable species, possessing a form of lemma peculiar to itself. The stipitate base of the lemma might better be considered a downward elongation of the callus, surrounding and becoming grown to the rachilla, which has likewise become elongated so that the joint is still at the base of the callus. This conception makes more apparent the relation of the plant to *F. subulata*.

The following specimens belong to this much-confused species:

VANCOUVER ISLAND:
  Without locality, Fletcher, June 16, 1885.
WASHINGTON:
  San Juan County, *Henderson* 2197.
  Seattle, *Piper* in 1889.
  Montesano, *Heller* 3998.
  Olympia, *Henderson* 2179.
OREGON:
  Astoria, *Piper* 6455.
  Portland, *Sheldon* 10479.
  Without locality, *Howell*, June, 1886.

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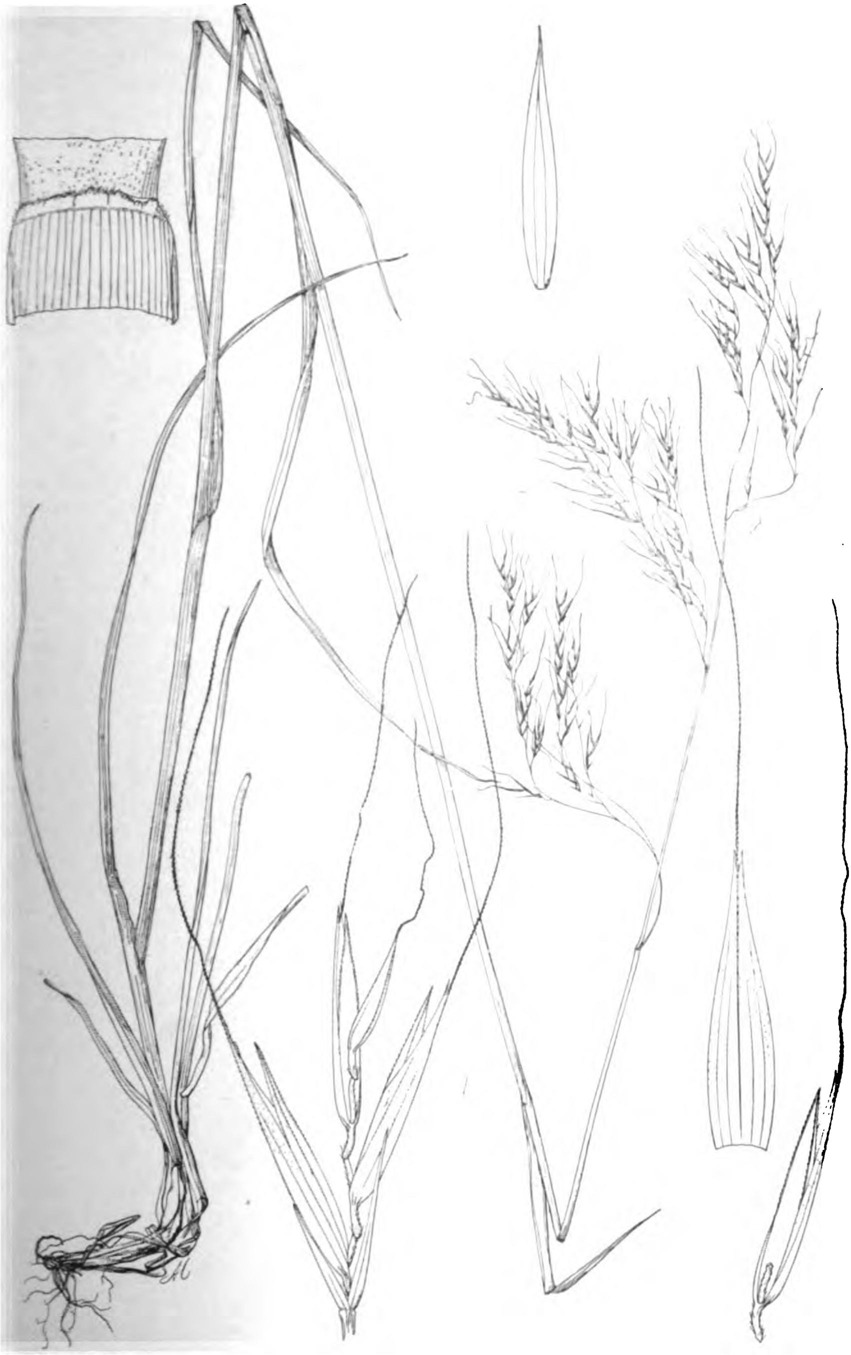
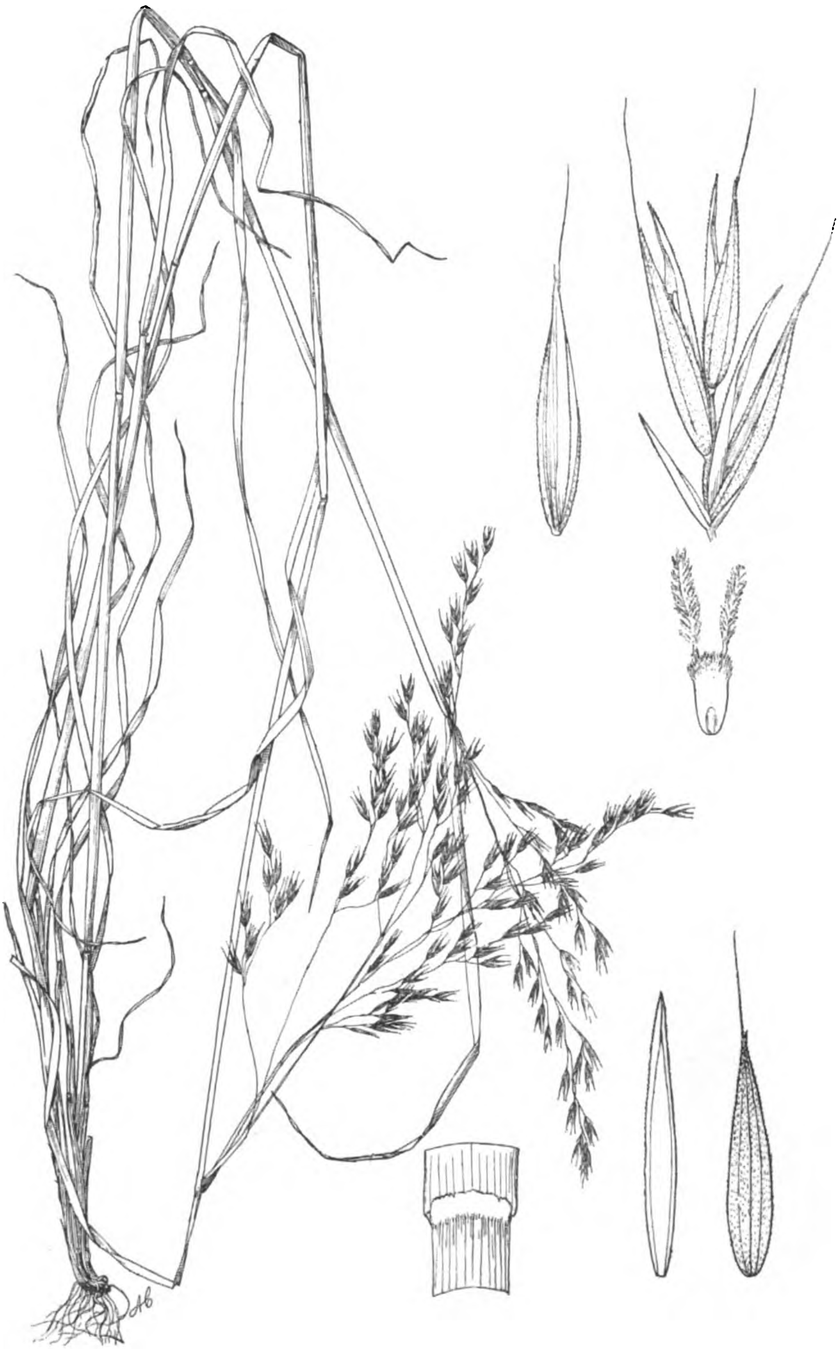
[a] Fl. Morbihan 731. 1852.



FESTUCA SUBULIFLORA SCRIBNER.

PLATE XIV.



FESTUCA ELMERI SCRIBN. & MERR.

CALIFORNIA:

Humboldt Bay, *Chandler* 1184.
Crescent City, *Davy & Blasdale.*
Kneeland, Humboldt County, *Blankinship* 7.

EXPLANATION OF PLATE.—Drawn from 19 *Howell*, collected in Oregon; plant one-half natural size; details magnified five times.

29. **Festuca dasyclada** Hack.

Festuca dasyclada Hack.; Beal, Grasses N. Am. **2**: 602. 1896. This well-marked species has been collected only by Dr. C. C. Parry in 1875, somewhere in the Rocky Mountains, "in Utah," according to Beal. The type was the specimen in the herbarium of Professor Scribner, now destroyed. A duplicate in the National Herbarium has no locality given on the label.

DESCRIPTION.

Culms erect or somewhat geniculate, 20 to 40 cm. high, nearly smooth, 3-jointed; sheaths shorter than the internodes, striate, glabrous; ligule very short; blades narrow, soft, folded, glabrous, acute, 5 to 15 cm. long; panicle open, erect, the rays in twos, threes, or fours, ciliate on the prominent angles, mostly branched, a pulvillus at the base of each ray and branch; spikelets pale green, oblong-lanceolate, long-stalked, 2-flowered, 6 to 7 mm. long; joints of the rachilla 1.5 mm. long, scabrous; glumes lanceolate, glabrous, except on the keel, the lower 1-nerved or faintly 3-nerved, 4 mm. long, the upper 3-nerved, 6 mm. long; lemma lanceolate, green, membranous, 5-nerved, somewhat keeled, scabrous-puberulent all over the back, about 6 mm. long, the apex cleft, a scabrous awn 3 mm. long arising from between the teeth; palea a little shorter than the lemma, obtuse at apex, the nerves ciliate-scabrous.

30. **Festuca elmeri** Scribn. & Merrill.

Festuca elmeri Scribn. & Merrill, Bull. Torr. Club **29**: 468. 1902. Type in the National Herbarium, collected by A. D. E. Elmer (no. 2101), at Stanford University, California.

DESCRIPTION.

Loosely tufted, the slender culms 40 to 100 cm. high, glabrous, faintly striate, 3-jointed; sheaths striate, nearly smooth, shorter than the internodes; ligule short, ciliate; blades flat or loosely involute, nearly glabrous beneath, scabrous or pubescent above, 20 to 40 cm. long, those of the culm 2 to 4 mm. wide, the basal ones narrower; panicles 10 to 20 cm. long, pale green, loose and open; rays slender, angled, mostly in pairs, smooth or nearly so, pulvillate at base, spikelet-bearing above the middle; spikelets 7 to 10 mm. long, 3 or 4-flowered; joints of the rachilla hispidulous, 1.5 mm. long; glumes unequal, lanceolate, glabrous or nearly so, the lower 1-nerved, 2 to 2.5 mm. long, the upper 3-nerved, 3 to 4 mm. long; lemma lanceolate, green and membranous, 5-nerved, 6 to 6.5 mm. long, minutely hispidulous, cleft at the apex and bearing from between the short teeth a scabrous awn 2 to 8 mm. long; palea narrowly lanceolate, a little longer than the lemma, the two scabrous nerves meeting in the acuminate apex, the inflexed sides very narrow. (Plate XIV.)

This perfectly distinct species has been much confused, there being really considerable material in all the larger herbaria. The following specimens belong here:

CALIFORNIA:

Mendocino County, *Bolander* 6463.
Ukiah, Mendocino County, *Davy & Blasdale* 5029.
Highland Springs, Lake County, *Davy* 6648.
Tassajara Hot Springs, Monterey County, *Elmer* 3322.

CALIFORNIA—Continued.
Stanford University, *Abrams* 1646.
Without locality, *Kellogg & Harford* 1116.*
Santa Cruz, *Anderson* in 1887.
Santa Cruz, *Anderson* in 1888.*
San Francisco, *Bolander* 1507.
Oakland, *Bolander*, June 1, 1866.
Templeton, San Luis Obispo County, *Davy* 7584.
Lake County, *Blankinship* 8.
Marysville Buttes, *Heller* 5562.
OREGON:
Eight Dollar Mountain, Josephine County, *Piper* 3512.

The specimens marked with an asterisk were cited by Doctor Vasey under the original description of *Festuca ambigua*, but the real type of that is a very different plant.

EXPLANATION OF PLATE.—Drawn from type specimen 2101 *Elmer*, collected at Stanford University, California. Plant one-half natural size; parts enlarged five diameters, except the ovary, which is enlarged ten diameters.

30a. **Festuca elmeri luxurians** nom. nov.

Festuca jonesii conferta Hack.; Beal, Grasses N. Am. **2**: 593. 1896. The type was in the herbarium of Professor Scribner, since destroyed by fire. A duplicate is in the National Herbarium. It is from San José Normal School, California, the collector unknown.

Typical *Festuca elmeri* has a very loose panicle and 3 or 4-flowered spikelets. The subspecies has a rather close panicle and 5 or 6-flowered spikelets. The following specimens are in the National Herbarium.

CALIFORNIA:
Stanford University, *Elmer* 2133, 2103.
Without locality, *Bolander* 6073.
Without locality, *Lemmon* 4654.

The name *conferta* has been previously used as *Festuca arundinacea conferta* Hack. Mon. Fest. 157. 1882.

31. **Festuca gigantea** (L.) Vill.

Bromus giganteus L. Sp. Pl. **1**: 77. 1753. "Habitat in Europae sylvis siccis."

Festuca gigantea Vill. Hist. Pl. Dauph. **2**: 110. 1787. Transfers the species to Festuca.

This European species is sparingly introduced in the Eastern States.

DESCRIPTION.

Stems erect, striate, glabrous, 3 to 5-jointed, usually nearly concealed by the sheaths, 60 to 120 cm. high; sheaths smooth or somewhat scabrous; ligule very short, truncate; blades flat, linear-lanceolate, 12 to 40 cm. long, 5 to 15 mm. broad, acute, prominently auriculate at base, dark green and smooth beneath, paler and slightly roughened above, very scabrous on the margins; panicle oblong-ovoid, 10 to 40 cm. long, at length spreading, somewhat drooping; rays slender, mostly in twos, elongate, very scabrous on the angles, each pulvillate at base; spikelets pale green, oblong-lanceolate, 10 to 13 mm. long, 5 to 9-flowered; joints of the rachilla cylindric, scabrous; glumes very acute, glabrous, the lower 1-nerved, 5 to 6 mm long, the upper 3-nerved, 6 to 7.5 mm. long, broadly hyaline-margined; lemma lanceolate, convex, 5-nerved, sparsely scabrous, especially on the nerves above, 7 to 9 mm. long, bidentate at the scarious apex, bearing a scabrous awn more than twice as long as itself; palea oblong-lanceolate, acute or somewhat notched at the apex, the nerves scabrous, the inflexed sides half as broad as the internerve.

32. **Festuca fratercula** Rupr.

Festuca fratercula Rupr.; Fourn. Mex. Pl. **2**: 124. 1881.[a] Type collected on Mount Orizaba, Mexico, at 3,500 to 3,580 meters altitude, by Galeotti.

DESCRIPTION.

A loosely tufted, glabrous perennial, 60 to 90 cm. high; stem erect, slender, very smooth and shining, with 3 nodes; offshoots few, extravaginal, rather short; sheaths smooth, much shorter than the internodes; ligule very short, truncate; blades thin, flat, spreading, linear, 10 to 25 cm. long, 3 to 6 mm. wide, quite smooth, scabrous on the margins, attenuate-acuminate to the convolute apex; panicle slender 10 to 15 cm. long, flexuous and somewhat nodding; rays mostly solitary, some in pairs, very slender, scabrous on the angles, usually branched below the middle, the longest 10 cm. long, ascending, flower-bearing in the upper third; spikelets oblong, 3 to 5-flowered, 7 to 12 mm. long; glumes membranous, green, the lower 1-nerved, ovate-lanceolate, acute, 1.5 to 2 mm. long, scarious-margined, scabrous on the keel; the upper oblong, 3-nerved, subacute, scarious-margined, scabrous on the keel; lemma 6 to 9 mm. long, 3-nerved, or with 2 additional faint intermediate nerves, lanceolate, keeled to the base, scabrous, and bearing at apex an awn 0.5 to 2 mm. long; palea linear-lanceolate, acute, scabrous on the nerves, 6 to 6.5 mm. long, the inflexed sides one-third as broad as the internerve; apex of ovary obtuse or emarginate and slightly hairy, the stigmas rather distant; lodicules oblique, entire or laciniate, as long as the ovary or shorter.

The following specimens are somewhat doubtfully referred to this species:

ARIZONA:
- Rincon Mountains, *Nealley* 177.

COLORADO:
- Pagosa Peak, *Baker* 178, 177, 36, 75, 94.
- Durango, *Tweedy* 393a.

33. **Festuca subulata** Trin.

Festuca subulata Trin. in Bong. Mem. Acad. St. Petersb. VI. **2**: 173. 1832. Type from the neighborhood of Sitka, collected by Mertens. Presumably it is in the St. Petersburg Academy of Science. We have seen no authentic specimen, but the ample description accords so well with plants from near the type locality that there is scarcely room to question the identity of the species.

Festuca jonesii Vasey, Contr. Nat. Herb. **1**: 278. 1893. Type in the National Herbarium, collected by M. E. Jones "in southern Utah," but Mr. Jones notes that the locality is really in the "Wasatch Mts., City Creek Canyon, above Salt Lake City."

We can find no characters by which *F. jonesii* can be kept distinct from *F. subulata*, even as a subspecies. The two type specimens are from almost the extremes of the range of the species. Contrasted with the Alaska specimens, the type of *F. jonesii* has slightly narrower leaves, and somewhat smaller spikelets, with its florets closer together, and the joints of the rachilla less scabrous. All manner of intergrades occur, however, and in such numbers that no satisfactory line of separation can be drawn.

DESCRIPTION.

Stems erect, obscurely striate, retrorsely scaberulous, 40 to 120 cm. high, 2 to 4-jointed; sheaths striate, nearly smooth, elongate but shorter than the internodes; ligule scarious, about 1 mm. long; blades dark green above, paler beneath, flat, thin, 10 to 30 cm. long, 3 to 10 mm. broad, auriculate at base, usually sharply scabrous on both faces, many-nerved, lax and spreading; panicle very loose and somewhat drooping, 15 to 40 cm. long; rays in 3 to 5 sets, mostly in twos, all pulvillate at base, slender, flexuous, angled, scabrous, few-branched above the middle; spikelets pale green, sometimes purplish-tinged, oblong-lanceolate, 3 to 5-flowered, 7 to 12 mm. long; joints of the rachilla cylindric, usually curved, scabrous, 1 to 2 mm. long; glumes subulate, glabrous, the lower 1-nerved, 2 to 3 mm. long, the upper 3-nerved, 3 to 4 mm. long, each sparsely scabrous near the apex; lemma green, membranaceous, narrowly lanceolate, 3-nerved, somewhat keeled for its whole length, scabrous toward the apex, 5 to 7 mm. long, attenuate into a scabrous slender awn, 5 to 20 mm. long; palea as long as the lemma or slightly longer, lanceolate, acute, the inflexed sides one-third as broad as the internerve, the nerves scabrous.

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[a] The original description is given on p. 46.

The species ranges from southeastern Alaska to northern California, and in the Rocky Mountains to Wyoming and Utah.

The following collections are representative:

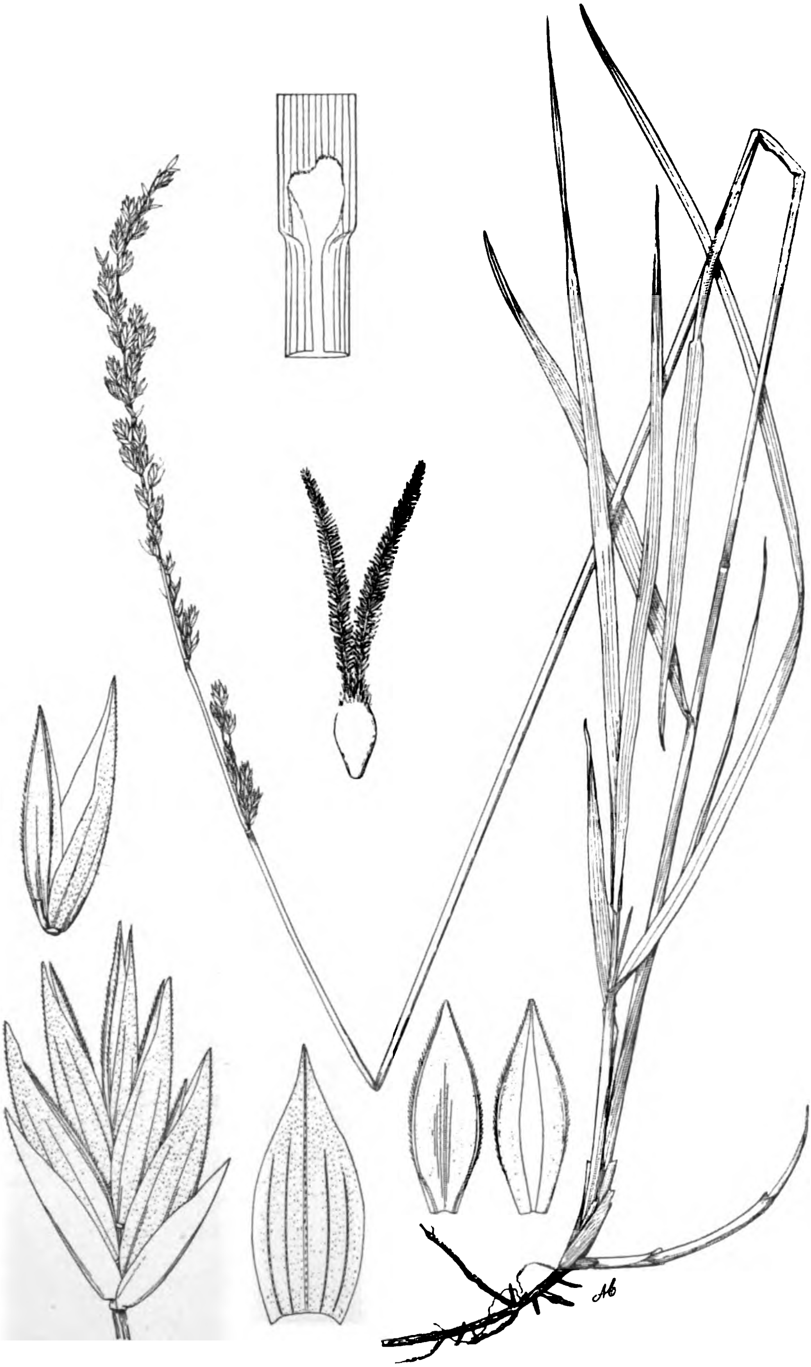
ALASKA:
    Foggy Bay, *Coville & Kearney* 2572.
    Howkan, *Evans* 120.
    Cape Fox, *L. J. Cole*, July 26, 1899.
BRITISH COLUMBIA:
    Queen Charlotte Island, *Newcombe*, July 24, 1897.
    Agassiz, *Macoun* 89.
    Chilliwack Valley, *Macoun* 26113.
WASHINGTON:
    Klickitat County, *Suksdorf* 170.
    Seattle, *Piper* 938, 957.
    Clallam County, *Elmer* 1918, 1916.
    Blue Mountains, *Horner* 559.
    Clark Springs, Spokane County, *Kreager* 38.
OREGON:
    Wallowa Mountains, *Cusick* 2507.
    Eagle Creek, *Cusick* 2434.
CALIFORNIA:
    Moulton, Warner Mountains, *Griffiths & Hunter* 473.
IDAHO:
    Lake Cœur d'Alene, *Sandberg, Heller, & MacDougal* 542.
WYOMING:
    Welcome, *Williams* 2685.
UTAH:
    Ogden, *Tracy* 363.
MONTANA:
    Bozeman, *Shear* 465.
    Columbia Falls, *Blankinship* 1042.

Subgenus III. HESPEROCHLOA subgen. nov.

Perennials, densely tufted, but producing occasional stout extravaginal stolons, stigmas elongate, the numerous short branches arising from all sides, simple or but little dentate; ovary deeply sulcate near the apex anteriorly, sparsely hispidulous above; caryopsis beaked and bidentate at apex; hilum linear.

34. Festuca confinis Vasey.

Poa? kingii Wats. Bot. King. Explor. 387. 1871. Type in the National Herbarium, collected by Watson in the East Humboldt Mountains, Nevada, July, 1868, altitude, 8,000 feet.



FESTUCA CONFINIS VASEY.

Festuca confinis Vasey, Bull. Torr. Club, **11**: 126. 1884. Type in the National Herbarium, collected by Dr. George Vasey at Penn Gulch, Colorado, altitude 8,000 feet.

Festuca kingii Scribner, U. S. Dept. Agr. Div. Agrost. Bull. **5**: 36. 1897. Transfers *Poa? kingii* Wats.

Festuca watsoni Nash in Britt. Man. 148. 1901. Proposes a new name for *Poa? kingii* Wats. on account of the older *Festuca kingiana* Endl.

DESCRIPTION.

Perennial, pale green, usually densely tufted, but occasionally producing stout, scaly, extravaginal stolons; culms stout, striate, glabrous, 40 to 100 cm. high, mostly 2-jointed; sheaths smooth, striate, about half as long as the internodes; ligule scarious, ciliate 1 to 7 mm. long; blades firm, flat, or loosely involute, coarsely striate, acute, 10 to 30 cm. long, 3 to 6 mm. wide; panicle narrow, erect, 8 to 20 cm. long; rays short, appressed, scabrous, in 6 to 8 sets of 1 to 3 each, floriferous nearly to the base; spikelets rather turgid, 3 to 5-flowered, 6 to 10 mm. long; joints of the rachilla cylindric, 1 to 2 mm. long, scabrous on the basal half; glumes broadly lanceolate, subscarious, nearly smooth, shining, the lower 1-nerved, 3 to 4.5 mm. long, the upper 3-nerved, one-half longer; lemma ovate, acuminate, convex, faintly nerved, scabrous all over the back, 5 to 8 mm. long; palea broadly lanceolate, obtuse, scabrous-ciliate on the keels, shorter than the lemma, the inflexed sides one-third as broad as the internerve; ovary sparsely hispidulous at apex, the stigmas 3 or 4 times as long. (PLATE XV.)

This species occurs in California, Nevada, southeastern Oregon, Utah, Wyoming, Montana, and Idaho.

EXPLANATION OF PLATE.—Drawn from specimen collected on Stove Prairie, Larimer County, Colorado, by Osterhout, June 23, 1897; plant one-half natural size; ovary enlarged ten diameters, the other parts five diameters.

34*a*. **Festuca confinis rabiosa** subsp. nov.

Leaves narrow, closely involute; lemma short-awned.

Collected on a branch of Crazy Womans Creek, Wyoming, at 2,700 meters altitude, by Williams and Griffiths (no. 25), July 3, 1898.

UNIDENTIFIED SPECIES.

Festuca ? delawarica (Link) Kunth, Rev. Gram. **1**: 129. 1829. (*Poa delawarica* Link, Hort. Berol. **1**: 174. 1827.) Type from Delaware. Evidently a Puccinellia.

Festuca glabra Spreng. Syst. **1**: 353. 1824. Type from "Long Island, Amer. Bor." Probably a Puccinellia.

Festuca pseudoduriuscula Steud. Syn. Pl. Gram. 312. 1854. Based on Drummond's 398 from Texas. An unnamed variety of the above is mentioned, based on Drummond's 389, also from Texas. A specimen of the latter in the Gray Herbarium is *Festuca obtusa* Spreng., but this is not consistent with Steudel's description.

Festuca texana Steud. Syn. Pl. Gram. 310. 1854. Based on Drummond's 387 from Texas.

Festuca villiflora Steud. Syn. Pl. Gram. 313. 1854. Type from Labrador. Probably *F. rubra kitaibeliana* ex char.

SPECIES EXCLUDED.

Festuca acutiflora Bigel. Fl. Bost. 37. =*Panicularia acutiflora.*

Festuca agrostidea La Pylaie, Mem. Soc. Linn. Par. **4**: 421, nom. nud.

Festuca aquatica Bosc; R. & S. Syst. **2**: 615, as synonym. =*Leptochloa fascicularis.*

Festuca bicornis Schreb.; Steud. Nom. ed. 2. **1**: 628, as synonym. =*Panicularia acutiflora.*

Festuca borealis Mert. & Koch in Röhling, Deutschl. Fl. ed. 3. **1**: 664. =*Graphephorum arundinaceum.*

Festuca borealis Hook. Fl. Bor. Am. **2**: 251. =*Graphephorum festucaceum.*

Festuca brevifolia Muhl. Gram. 167. =*Triplasis purpurea.*

Festuca caroliniana Steud. Syn. Pl. Gram. 312. =*Triplasis purpurea*, ex char.

Festuca cepacea Phil. Linnaea **33**: 297. =*Melica cepacea* Scribner.

Festuca clandestina Muhl. Gram. 162. =*Leptochloa fascicularis.*

Festuca decumbens L. Sp. Pl. **1**: 75. =*Triodia decumbens.*

Festuca diandra Michx. Fl. Bor. Am. **1**: 67. *pl. 10.* =*Korycarpus diandrus* Kuntze.

Festuca distans Kunth, Rev. Gram. **1**: 129. =*Puccinellia distans.*

Festuca distichophylla Michx. Fl. Bor. Am. **1**: 67. =*Distichlis spicata.*

Festuca fascicularis Lam. Tab. Encycl. **1**: 189. =*Leptochloa fascicularis.*

Festuca filiformis Lam. Tab. Encycl. **1**: 191. =*Leptochloa mucronata.*

Festuca fluitans L. Sp. Pl. **1**: 75. =*Panicularia fluitans.*

Festuca grandiflora Lam. Tab. Encycl. **1**: 84. =*Arundinaria macrosperma* fide Steudel, Nom. ed. 2. **1**: 630.

Festuca grandiflora Lam. Tab. Encycl. **1**: 191. =*Panicularia acutiflora.*

Festuca macrostachya Torr. & Gr. Pac. R. Rep. **2**^{4}: 177, nom. nud. =*Scleropogon brevifolius*, staminate plant, fide specimen in Herb. Gray.

Festuca multiflora Walt. Fl. Car. 81. =*Leptochloa mucronata.*

Festuca neogaea Steud. Syn. Pl. Gram. 313. Through the kindness of Mons. Raymond Le Bey we have received some spikelets of the type of this plant preserved in the University of Caen. The species is unquestionably *Poa eminens* Presl (*Poa glumaris* Trin.).

Festuca nervosa Hook. Fl. Bor. Am. **2**: 251. =*Poa nervosa.*

Festuca ? nuttalliana Kunth, Rev. Gram. **1**: 129. =*Puccinellia airoides.*

Festuca obtusiflora Willd.; Spreng. Syst. **1**: 356. = *Leptochloa dubia.*

Festuca polystachya Michx. Fl. Bor. Am **1**: 66. =*Leptochloa fascicularis.*

Festuca procumbens Muhl. Gram 160. =*Leptochloa fascicularis.*

Festuca prostrata Muhl.; Merrill, Div. Agrost. Circ. **27**: 5. =*Leptochloa fascicularis.*

Festuca purpurea F. Newell, Sel. Pl. Indust. Cult. 88. =*Triplasis purpurea.*

Festuca purpurea Schreb.; Steud. Nom. ed. 2. **1**: 632. =*Triodia cuprea.*

Festuca rigida (L.) Kunth, Rev. Gram. **1**: 129. 1829. =*Scleropoa rigida.*

Festuca spicata Nutt. Gen. **1**: 72. = *Distichlis spicata* ex char.

Festuca spicata Pursh, Fl. Am. Sept. **1**: 82. =*Agropyron divergens* Nees.

Festuca triticea Lam. Tabl. Encycl. **1**: 190. =*Distichlis spicata.*

Festuca triticoides Lam.; R. & S. Syst. **2**: 596. =*Distichlis spicata.*

Festuca unioloides Willd. Enum. Hort. Berol. **1**: 3. *pl. 3.* =*Bromus unioloides.*

Festuca virgata Lam. Ill. **1**: 189. =*Leptochloa virgata.*

NOTES ON MEXICAN SPECIES.

The Mexican species of Festuca are too poorly known and too sparsely represented in our herbaria to permit of satisfactory treatment at present. The following notes give our present knowledge concerning them:

Festuca octoflora Walt.

The following Mexican specimens have been examined:

Guadalupe Island, *Palmer* 657.
Hanson's ranch, *Orcutt*, July 9, 1884.
Guadalupe Ranch, *Orcutt* 1432 in part.
San Martin Island, *Anthony* 214.
Todos Santos Island, *Anthony* 195.

Festuca octoflora hirtella Piper.

See page 12.

Festuca pacifica Piper.

See page 12.

Festuca myuros L.

Near Toluca, State of Mexico, *Rose & Painter* 6786.
Mount Iztaccihuatl, *Deam* 22.

Festuca megalura Nutt.

See page 17.

Festuca rubra glaucodea Piper.

See page 22.

Festuca ovina elliptica (Beal).

Festuca amplissima elliptica Beal, Grasses N. Am. **2**: 603. 1896. Type collected in the Sierra Madre, Chihuahua, by Pringle (no. 1438). Also collected in the State of Durango, by Rose (no. 2358).

This plant is closely allied to *F. ovina arizonica* Hack., differing in its broader, loosely involute leaves, which are scabrous above and smooth beneath, and perhaps in a taller habit. Some specimens of Pringle's 1438 are awnless, others are short-awned.

Festuca hephaestophila Nees.

Festuca hephaestophila Nees; Steud. Syn. Pl. Gram. 310. 1854. Type Hartweg's no. 629 from Volcan de Agua, Guatemala.

DESCRIPTION.

Densely tufted, the underground portions of the stems erect or decumbent, densely covered by the persisting brown scarious sheaths; culms erect, 10 to 40 cm. high, smooth, 2-jointed; sheaths of the culm elongated, extending halfway to the panicle or more, smooth, somewhat glaucous; ligule very short; blades straight or curved, closely involute, firm, glaucous, acute at apex, slightly scabrous on the margins, 2 to 6 cm. long; panicle purple, erect, narrow, usually close, 2 to 5, rarely 8, cm. long; rays short, solitary, scabrous on the angles, floriferous nearly to the base; spikelets 3 or 4-flowered, 5 to 6 mm. long, somewhat glaucous; joints of the rachilla cylindric-clavate, nearly smooth, 1 mm. long; glumes unequal, smooth or scabrous on the keels, scarious-margined, the lower subulate-triangular, 1-nerved, 2 to 3 mm. long, the upper 3-nerved, rarely 5-nerved, 4 to 4.5 mm. long; lemma firm, convex, faintly nerved, ovate-oblong, acuminate, smooth, 3 to 5 mm. long; palea oblong, shorter than the lemma, bifid at apex, the nerves scabrous; ovary glabrous at apex.

The following specimens have been examined:

Mount Orizaba, *Liebmann* 409.
Mount Orizaba, *Pringle* 8588.
Nevada de Toluca, *Pringle* 4221.
Iztaccihuatl, *Purpus* 228.

Festuca liebmanni Fourn.

Festuca liebmanni Fourn. Mex. Pl. **2**: 124. 1881.

"Foliis scaberrimis longissimis lineari-lanceolatis, summo paniculam superante, ligula brevi fimbriata; panicula racemosa erecta, axillis glabris, radiolis appressis scabris; spiculis 4-5-floris, flore terminali abortivo; glumis valde inaequalibus, superiore fere duplo majore obtusa; palea inferiore 5-nervi apice potissimum et in mesonervo prominente scabra, secus marginem erubescente, apice longe mucronata; palea superiore angusta breviore bidentata.

"Absque loco (Liebm. n. 517)."

This species is unknown to us.

Festuca tolucensis H. B. K.

Festuca tolucensis H. B. K., together with its supposed synonyms *F. multiculmis* Steud., and *F. aequipaleata* Fourn., belong to a group of Mexican species that we are unable to clear up with the evidence and material at hand. The group differs from other Mexican species by the leaves possessing large ligules and the palea being bifid. The species are allied to *F. thurberi* Vasey, but differ in the bifid palea and awned lemma.

The following are the original descriptions:

Festuca tolucensis H. B. K. Nov. Gen. & Sp. **1**: 153. 1815.

"F. culmis, vaginis foliisque scabris, setaceo-triquetris; panicula simplici, laxa, ramis alternis, rhachique scabris; spiculis obovato-oblongis, compressis, subsexfloris; glumis paleisque scabris; arista brevi.

"*Crescit in montosis, scopulosis, apricis regni Mexicani, inter Islahuaca et Toluca, alt. 1380 hexap.* ♃ *Floret Septembri.*

"Radix fibrosa. Culmi caespitosi, erecti, bipedales, simplices, striati, scabriusculi. Folia convoluto-setacea, triquetra, apice subulata, scabra. Vaginae striatae, carinatae, scabrae. Ligula ovata, obtusa, glabra. Panicula simplex, laxa, quadri- aut quinquepollicaris, ramis alternis, adscendenti-patulis, triquetris, scabris, distantibus. Rhachis triquetra, scabra. Spiculae obovato-oblongae, quinque- aut sexflorae, floribus distantibus. Glumae ovato-lanceolatae, acuminato-subulatae, carinatae, purpurascentes, scabrae, inaequales, inferior dimidio brevior et angustior, superior spicula dimidio brevior. Paleae lanceolatae, purpurascentes, scabrae, apice bidentatae, inferior superiore paullo longior, inter dentes breviter aristata, superior bicarinata."

Festuca multiculmis Steud. Syn. Pl. Gram. 310. 1854.

"Radice validule fibrosa, caespitifera, caespitibus constantibus e plurimis culmis sterilibus foliiformi convolutis rigidis basi vaginatis et foliiferis culmum fertilem (solitarium, an semper) aequantibus; vaginis striatis foliis brevibus convolutis; culmi floriferi foliis inferioribus sterilibus similibus, superioribus planiusculis angustissimis; vaginis scabriusculis; panicula simplici (2–3-pollicari) laxa; radiis solitariis alternis inferioribus 3- superioribus uni-spiculatis; spiculis ovatis patulis laxis (3 ‴ et ultra longis) sub-5-floris glumis inaequalibus flosculis brevioribus; valvula inferiore scabra fusco purpurea infra lutescenti-albida obscure nervosa simpliciter acuminata vel ex apice brevissime bidentula aristulata. An F. tolucensis H. B. var.? Heller Hrbr. nr. 306. Mons Tolucco Mexico."

Festuca aequipaleata Fourn. Mex. Pl. **2**: 125. 1881.

"Differt a F. Tolucensi foliis retrorsum scabris, paleis aequalibus, inferiore breviter mucronata, superiore profunde bifida.

"In monte Orizabensi, 14,000′ (Liebm. n. 511, 513)."

In the National Herbarium are two sheets of specimens from Fournier, one of no. 511, Liebmann, the type of *F. aequipaleata* Fourn., the other no. 510, Liebmann, referred by Fournier to *F. tolucensis* H. B. K. Both of these sheets are mixtures, each containing apparently two species, representing in all three species, or else three forms of one variable species. The specimens all agree in having large ligules awned lemmas, and bidentate paleae, but differ in the form of the panicle, the size of the spikelets, and the shape of the florets. To complicate matters still more the remaining sheets examined all differ more or less, while retaining the essential characters of tufted habit, narrow involute leaves, long ligule, and awned lemma. Additional material is necessary before any satisfactory conclusion can be reached.

Specimens have been examined as follows:

Nevada de Toluca, *Rose & Painter* 7983.
Mount Orizaba, *Seaton* 193, 228.
Without locality, *Liebmann* 510, 511.
San Luis Potosi, *Parry & Palmer* 924.
Near Cima, *Rose & Painter* 7208.

Festuca rosei sp. nov.

Perennial, tufted; culms stout, over 1 meter high, 4 or 5-jointed, smooth and glabrous; sheaths smooth, those of the lower internodes equaling or exceeding them; ligule short, ciliate; blades of the numerous basal leaves filiform and involute, smooth, 30 to 40 cm. long, those of the culm stouter; panicle narrow, erect, about 20 cm. long; rays in about 5 sets, solitary, but nearly all with a short basal branch, somewhat scabrous on the angles; spikelets purplish, somewhat glaucous, oblong, 7 to 9 mm. long, 3 to 5-flowered; joints of the rachilla nearly smooth, cylindric; glumes unequal, firm in texture, scabrous on the nerve above, the lower lanceolate, 1-nerved, 3 to 4 mm. long, the upper oblong, 3-nerved, 4 to 5 mm. long; lemma firm in texture, with a very narrow scarious margin, ovate-lanceolate, acuminate, obscurely glaucous, 6 to 7 mm. long; palea lanceolate, bidentate, scabrous on the nerves, the inflexed sides less than half the internerve.

Type specimen collected near Cima, State of Mexico, by J. N. Rose and J. H. Painter (no. 7210), September 19, 1903.

This species is readily distinguished from any other known to us by its very slender leaves, stout culms, short ligules, and awnless lemmas.

Festuca willdenowiana Schultes.

Festuca mexicana Willd.; Spreng. Syst. **1**: 356. 1825.

"F. panicula nutante pauciflora, ramis flexuosis, spiculis 3-floris strigoso-hispidis aristatis, foliis linearibus angustissimis. Mexico."

Festuca willdenowiana Schultes, Mant. **3**: 650. 1825. Changes name of above, owing to the older *Festuca mexicana* R. & S. Syst. **2**: 732. 1817.

Fournier, followed by Hemsley, refers to this species a specimen collected by Schaffner without locality.

We have seen no authentic material of this species, but we would refer to it with little doubt the following specimens: *Seaton* 227 B, collected on Mount Orizaba, 4,200 meters altitude, August 7, 1891, and *Pringle* 4484, Sierra de las Cruces, State of Mexico, August 12, 1893. The former specimen is the type of *Festuca rubra pauciflora* Scribner.[a]

DESCRIPTION.

A tufted perennial; culms slender, erect, smooth and shining, 3-jointed, about 60 cm. high; sheaths striate, glabrous, shorter than the internodes; ligule nearly obsolete; blades narrow, pale green, rather soft, very smooth, loosely involute, 10 to 45 cm. long, acute at the apex; panicle narrow, 10 to 15 cm. long, nodding; rays slender, solitary, ascending, in about 3 sets, scabrous on the angles, pulvillate at base; spikelets pale green or somewhat purplish, lanceolate, 3 or 4-flowered, 8 to 10 mm. long; joints of the rachilla cylindric, scabrous, 1 to 1.5 mm. long; glumes glabrous, unequal, the lower subulate-lanceolate, 1-nerved, 2 to 3 mm. long, the upper

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[a] Proc. Am. Acad. **28**: 123. 1893.

3-nerved, 4 mm. long; lemma lanceolate, plainly 5-nerved, convex, the whole back appressed-scabrous or nearly hirtellous, about 7 mm. long, acuminate or often short-awned; palea linear-lanceolate, cleft at apex, about equaling the lemma, the nerves scabrous, the inflexed sides half as broad as the internerve.

Festuca fratercula Rupr.

Festuca fratercula Rupr.; Fourn. Mex. Pl. **2**: 124. 1881.

"Culmo fere tripedali scabro; foliis 3 ''' latis, retrorsum scabris, longis, planis, apice longe convolutis; ligula brevissima; panicula libera effusa fere pedali folium summum longe superante, radiis geminis divaricatis inaequalibus parce divisis; spiculis 3-floris cum terminali quarto abortivo; glumis inaequalibus acutis, floribus teretibus remotis, palea inferiore acuta potissimum in floribus summis breviter mucronata, glabra; squamulis lanceolatis ovarium aequantibus.

"In humidis inter Pinos montis Orizabensis, 11-12000 ' (Gal. n. 5778); *Cumbre de Estepa*, augusto (Liebm.)"

We have seen no Mexican specimens of this species, but have referred to it several collections from the United States.[a]

Festuca amplissima Rupr.

Festuca amplissima Rupr.; Fourn. Mex. Pl. **2**: 125. 1881.

Type collected by Galeotti, "Secus rivulos pr. Vaqueria del Jacal in monte Orizabensi," 3.225 meters.

DESCRIPTION.

Culms stout, 1 to 1.5 meters high, smooth or scabridulous, firm, 4 or 5-jointed; sheaths glabrous, striate above, shorter than the internodes, the lowermost becoming fibrous when old; ligule very short, truncate; blades flat or loosely involute, 6 to 12 mm. broad, 30 to 50 cm. long, slightly scabrous on each side; panicle 30 to 50 cm. long, erect, diffuse; rays in about 8 sets of 2 or 3 each, scabrous, branched; spikelets green or purplish, long-stalked, oblong-elliptic, flattened, 5 to 9-flowered, 9 to 13 mm. long; joints of the rachilla scabrous, about 1 mm. long; glumes unequal, glabrous, the lower 1-nerved, 3 to 3.5 mm. long, the upper broader, 3-nerved, 5 to 6 mm. long; lemma 6 to 7 mm. long, lanceolate, finely scabrous, subcarinate, the nerves rather prominent, acute; palea acute, a little shorter than the lemma, the nerves scabrous, the inflexed sides about half the width of the internerve.

Readily recognized by its stout habit and ample floribund panicle.

The following specimens have been examined:

Sierra de Ajusco, *Pringle* 9555.
Sierra de San Felipe, *C. L. Smith* 924.
Mount Zempoaltepec, *Nelson* 648.
Mountains near Patzcuaro, *Pringle* 3945.
Mount Orizaba, *Liebmann* (ex Fournier).
Desierto Viejo, *Bourgeau* 1307 (ex Fournier).

Festuca livida (H. B. K.) Willd.

Bromus lividus H. B. K. Nov. Gen. & Sp. **1**: 150. *pl. 689.* 1815. "Crescit in alta planitie Tolucana, alt. 1380 hexap."

Schedonorus lividus R. & S. Syst. **2**: 707. 1817.

Festuca livida Willd. in Spreng. Syst. **1**: 258. 1825.

Helleria livida Fourn. Mex. Pl. **2**: 129. 1881. All of these are based on *Bromus lividus* H. B. K.

Festuca grandiflora Steud. Syn. Pl. Gram. 311. 1854. Based on Heller's 315 from Volcano de Toluca.

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[a] See p. 39 above.

DESCRIPTION.

Densely tufted; culms smooth, 10 to 20 cm. high, nearly covered by the overlapping sheaths; sheaths smooth, about 6 to each culm; ligule truncate, scarious, 0.5 mm. long; blades closely involute, very smooth, erect, 5 to 8 cm. long; panicle consisting of few to several (2 to 15) large purple spikelets; spikelets 10 to 14 mm. long, 2 to 4-flowered; joints of the rachilla hispidulous, 1 to 1.5 mm. long; glumes subequal, lanceolate, smooth or minutely scabrous, 10 to 15 mm. long, nearly equaling the spikelet; lemma minutely scabrous, elliptic-lanceolate, 8 to 10 mm. long, bearing a short, straight awn; palea shorter than the lemma, bidentate at apex, scabrous on the nerves, the inflexed sides half as broad as the internerve.

A very peculiar species upon which Fournier founded the genus Helleria, which, however, seems not distinct enough from Festuca. The species was poorly figured by H. B. K., but has been finely plated by Hemsley.[a]

The following specimens have been examined:

Crater of Nevado de Toluca, *Pringle* 4304, *Rose & Painter* 8017.
Iztaccihuatl, *Purpus* 27.
Perote, *Nelson* 45.
Volcano Toluca, *Nelson* 3.
Mount Orizaba, *Liebmann*.

Festuca procera H. B. K.

Festuca procera H. B. K. Nov. Gen. & Sp. **1**: 154. 1815. "Crescit locis alsis, subfrigidis regni Quitensis prope Chillo, San Antonio de Lulumbamba et Lloa, inter alt. 1280 et 1470 hexap."

Diplachne procera Spreng. Syst. **1**: 351. 1825. "Quito." *Festuca orgyalis* Willd. in herbarium and *F. procera* Humb. are cited as synonyms.

Festuca orgyalis Willd.; Fourn. Mex. Pl. **2**: 124. 1886. Based on *Diplachne procera* Spreng.

Fournier cites as a Mexican specimen Bonpland's no. 2285 in Herbarium Mus. Par. "absque loco, e Nova-Hispania," and further remarks that it differs from *F. procera* H. B. K. especially in its smooth culm, implying that *F. orgyalis* is distinct from that. Hemsley cites *F. orgyalis* as from South Mexico—on the authority of Humboldt and Bonpland. But *F. orgyalis* is founded on the name *Diplachne procera* Spreng. and on nothing else; and this in turn seems clearly founded on *Festuca procera* H. B. K., notwithstanding that Sprengel says "culmo procero glabro," while H. B. K. have it "culmo scabro." The literary evidence indicates that the supposed Mexican specimen of Bonpland is probably some of the original material of *Festuca procera*. The species is unknown to us.

Festuca mirabilis sp. nov.

Densely tufted; culms very stout, 1 to 2 meters high, 4-jointed, cylindric, smooth, faintly striate; sheaths striate, scabrous, mostly shorter than the internodes; blades pale-green, firm, mostly folded, 3 to 5 mm. broad, striate and scabrous on both sides, 50 to 80 cm. in length, long-attenuate to the apex; ligule scarious, truncate, short on the basal leaves, 4 to 5 mm. long on the culm leaves; panicle 20 to 30 cm. long, rather loose, usually secund, somewhat drooping, equaled or overtopped by the uppermost leaf; axis smooth below, scabrous above; rays in about seven series, usually in twos, slender, scabrous, simple or with but few branches, spikelet-bearing at the tips; spikelets yellowish-green, strongly flattened, 5 to 7-flowered, 1.5 to 2 cm. long; joints of the rachilla cylindric, 1 to 2 mm. long, strongly scabrous-hirtellous; glumes subulate, the lower 1-nerved, 7 mm. long, the upper 3-nerved, 10 mm. long;

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[a] Biol. Centr. Am. Bot. **3**: 528. *pl. 102 b.*

lemma sparsely scabro-hirtellous all over, the lower 12 to 15 mm. long, firm, green, strongly keeled nearly to the base, bifid at apex, and bearing a scabrous awn 3 to 4 mm. long; callus prominent, smooth; palea lanceolate, sparsely hirtellous, bifid at apex, equaling or a little exceeding the lemma, the inflexed sides half as broad as the internerve; stamens yellow, linear, 5 mm. long; ovary smooth.

Collected at Alvarez, about 2,700 meters altitude, State of San Luis Potosi, Mexico, by Dr. Edward Palmer, July, 1904.

This remarkable species is larger and coarser than any other native North American or Mexican species.

The following notes have been contributed by the discoverer, Dr. Edward Palmer:

"This grass is called 'zacate yerba,' and causes concern to owners of domestic animals. It grows in low, rich lands in large bunches 3 to 4 feet high, and has a yellowish cast. Domestic animals once injured by eating this grass, and having recovered, are said to avoid it afterwards. Three jackasses were poisoned by it at the time of my visit to Alvarez. They quickly became dizzy and helpless. Doses of oil and beans were promptly administered, which relieved two, but the third died. The animal which died had been on the place for a long time. It is commonly supposed that only animals new to the country eat this grass. It is probable that if the beans had been pounded fine before administering, a more rapid action would have resulted. There was so much good grass this year that it was not necessity that drove the animals to eat this rough, rasp-leaved plant. It is a question whether death resulted from some poisonous quality or from mechanical injury to the stomach caused by the rough leaves."

MEXICAN SPECIES EXCLUDED.

Festuca fascicularis Lam. Tabl. Encyc. **1**: 189. = *Leptochloa fascicularis* Gray.
Festuca fournieriana Hemsl. Biol. Cent. Am. **3**: 581. = *Gouinia polygama* Fourn.
Festuca mexicana R. & S. Syst. **2**: 732. = *Brachypodium mexicanum* Link.
Festuca obtusiflora Willd; Spreng. Syst. **1**: 356. = *Leptochloa dubia* Nees.
Festuca pendulina Steud. Syst. **1**: 356. = *Bromus pendulinus* Sessé.
Festuca pilosa Willd; Spreng. Syst. **1**: 356. = *Megastachya panamensis* Presl.
Festuca scabra Lag. Gen. et Sp. 4. = *Brachypodium mexicanum* Link.
Festuca virgata Lam. Ill. **1**: 189. = *Leptochloa virgata* Beauv.

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SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM

# CONTRIBUTIONS
FROM THE
UNITED STATES NATIONAL HERBARIUM

VOLUME X, PART 2

THE GENUS PTELEA IN THE WESTERN AND SOUTHWESTERN UNITED STATES AND MEXICO

By EDWARD L. GREENE

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PREFACE.

This paper by Dr. Edward L. Greene, Associate in Botany, United States National Museum, is the result of an exhaustive study of the western species of Ptelea. He finds that this genus instead of being composed of only a few species is a very large one, and describes 59 species, of which 55 are new. His work is based chiefly on the large series of specimens in the National Herbarium, in his own collection now deposited here, and in Capt. John Donnell Smith's, eventually to come here, together with the collections of the late C. C. Parry and that of the California Academy of Sciences.

The types are chiefly in the National Herbarium, and unless otherwise indicated are to be understood as belonging here.

J. N. Rose,
Associate Curator.

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THE GENUS PTELEA IN THE WESTERN AND SOUTHWESTERN UNITED STATES AND MEXICO.

By Edward L. Greene.

INTRODUCTION.

This genus, in so far as known exclusively North American, and in my view of it somewhat anomalous and of not very certain affinity, has been long in need of taxonomic investigation. In the days of George Bentham and Asa Gray it was received as consisting of about five species; one of them supposed to range all the way from New England and Canada to the sources of the Mississippi, thence southward over the whole country even to the shores of the Gulf of Mexico. A second Ptelea was recognized as local in Florida, while to all those empires of territory lying westward between the Mississippi River and the Pacific Ocean and including the whole of Mexico were credited three species—all recognized as typically Mexican, but believed to include all the Ptelea of Texas, of California, and of all the vast regions lying between those States. It is, indeed, less than ten years since it was given out that we have in all North America north of Mexico only two species and two varieties of Ptelea.[a]

But in this first decade of the twentieth century everyone will recognize that such a range as has been accorded to Bentham's middle Mexican *P. angustifolia* is impossible—at least, to any mind having an understanding of all those extremes of diversity as to soil, climate, altitude, and other potently influential conditions which exist between southern Mexico and such regions as Texas and Oklahoma on the one hand and Arizona and northern California on the other.

It was long since due that the investigation of this genus as existing in the West and Southwest should be taken in hand. The center of distribution for Ptelea lies somewhere in that direction. The uncounted canyons cutting into the great Mexican plateau, so rich in species of many another genus, abound in Pteleas, and so do Mexican mountains everywhere. The like is as true of perhaps a hundred isolated mountain ranges of less extent rising up out of the midst of west Texan, New Mexican, and Arizonian deserts, which might be even more prolific of Ptelea species. The Grand Canyon of the Colorado and its tributary gorges seem to abound in them, all hitherto undescribed; and the same is true in respect to other extensive districts, all quite different one from another, in Utah, New Mexico, Colorado, and California.

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[a] Synoptical Flora of North America, volume 1, part 1, pp. 372, 373. 1897.

The distributions of Mexican plant specimens, so copiously made by Mr. Pringle and by Dr. E. Palmer during forty years past, include no small number of Pteleas, all of which, until within the last year, have been sent forth without any critical examination at all under the one convenient name of *P. angustifolia*, while of that species itself neither of the noted explorers and collectors named appears ever to have obtained a specimen.

At different times within the last twenty-five years the present writer has gathered in several parts of New Mexico, Arizona, and California members of this genus which he was never able to identify, and which are herein first described.

At the National Herbarium there is special wealth of material in this as in many another genus, which has been procured, as it were, by special agents who have gone into many a remote and obscure corner of the West and brought back plant specimens of great value. By wise prevision of the curators in botany, Mr. Coville and Dr. Rose, the collecting of plants—at least one set—has been for years enjoined upon field parties going from the Department of Agriculture, the Geological Survey, the Bureau of Fisheries, etc., to the interior of the remoter territories; and as a result of such work our plant collection is rich beyond comparison in plants collected by this means, which are to be found in no other herbarium, whether of our own country or any other.

To the great wealth of specimens thus gathered here, I have been able to add, by courteous loan, the Ptelea specimens from the herbarium of Capt. John Donnell Smith, of Baltimore, those belonging to the Parry Herbarium from the Iowa State College, and those of the California Academy at San Francisco, in which also occur the types of several new species. All of these last, received much more than a year since, now by virtue of my prolonged retention of them have escaped the sad fate that befell almost the whole of that priceless herbarium in the recent earthquake and fire.

In the earliest hours devoted to close inspection and comparison, it became manifest that the real characters for species in Ptelea had never yet been indicated or apprehended. In other genera of woody growths, the oaks, for example, he who would distinguish and arrange the species could do nothing were he to leave unnoticed and unnoted the color and other characteristics of their trunks, their branches, and their twigs of one year's growth; and of actually supreme taxonomic importance in the case of the oaks are the color, texture, duration, marginal indentation, and pubescence of the leaves. Not even the characteristics of the acorns are found to be of equal weight with the mere hue and texture of foliage in the classification of the oaks. And all this I find true in regard to Ptelea, and even more; for the characteristics of twigs of one season's growth in this genus, their colors, kinds, and degrees of pubescence, evenness and unevenness of surface, etc., are many times more diverse than they are in any oaks; and both those sets of characters—those furnished by the twigs and those presented by color and texture of foliage—either set indispensable to any natural arrangement of Ptelea species, are here for the first time brought to notice. The chaos that has reigned hitherto in respect to Ptelea of the farther West and Southwest has held sway because it has not been seen that, in the species of one region, the twigs are chestnut-brown and velvety in one set, chestnut-brown and smooth and shining in another set; while in another and remoter district all the species have cinnamon-red warty twigs; and in a third group the twigs in all the species are either yellowish or straw-colored or nearly white and in almost all smooth and shining. I say with confidence that these marked diversities which even the dead and dry herbarium specimens exhibit can not have been looked at; for no botanist would pretend that one species of shrub or tree could so vary in respect to the bark of its twigs and branches.

The fruits in this genus are also found to present a considerable array of characters available for specific diagnosis, and also even for the grouping of the species; and some new descriptive terms have seemed to be called for in connection with them. The body of the samara, while in the broad, thin-leaved species it is thin and rather flat as well as small in proportion to the wing, is by comparison large and double-convex as well as more narrowly winged in the species that have a thick and subcoriaceous foliage. This seed-bearing body is in some marked by rather closely parallel transverse ridges, with lines of gland dots running between them, or else the ridges are irregularly broken and run into a reticulation, with one or more dots in the middle of each mesh. In either instance the ridges may, at the edge of the body or a little beyond it, unite to form a wall more or less definitely surrounding the body—which wall I denominate the circumvallation—or they may pass directly into the reticulation of the wing itself, leaving the body without circumvallation.

In the Californian group of species the ridges of the body of the fruit are mostly faint or obsolete, in which case the gland dots are multiplied and very conspicuous, in the Lower Californian nearly or quite wingless species rising into a prominent tuberculation. Again, and with respect to its proximity to either the base or the summit of its winged margin, the seed-bearing body is central in some and variously eccentric in perhaps the greater number. This body of the fruit, in its germinal stage in the flower—that is, as an ovary—is raised on a gynophore or stipe, which stipe, lengthening afterwards with the growth of the wing in which it is merged, yet appears on the surface of the wing below the body, just as the lengthened style is manifest as a line running along the surface of the wing above the body. I have expressed the centricity of the body by the phrase, "style and stipe equal," its eccentricity in the direction of the base by "style longer than the stipe," its nearer approach to summit—a rare condition—by "style shorter than the stipe."

Each one of the three natural groups of Ptelea here outlined has its own geographical limits, and nothing in this study has more deeply interested the investigator than the geographic distribution of the groups.

The principal one of the three—that is, the group richest in species and of most extended and varied range, the group with chestnut-brown twigs and prevailingly glaucescent or bluish-green foliage—is dispersed throughout at least middle and northern Mexico, as well as adjacent southern Arizona, New Mexico, and Texas, thence northward along the Mississippi to the Great Lakes, and everywhere eastward to the Atlantic.

A second group, that with twigs almost white and foliage yellow green, forms a belt which runs eastward from northwestern Arizona along the Grand Canyon of the Colorado, there and in southern Utah forming a curious sort of boundary to the distribution of Ptelea northward in that part of the country, the belt reaching its eastern limit in the canyon of the Arkansas in southern Colorado, from which point, and still as a narrow belt, it runs down the Rio Grande to the neighborhood of El Paso, Texas; the belt in this part of its course not limiting but intersecting the great main division of the genus.

The third group, that with cinnamon-colored twigs, a quite peculiar hue and venation of foliage, and narrow-winged or even wingless samaras, extends in also a narrow belt, running northward and southward west of the crest of the Sierra Nevada, between northern California and at least the middle of the Lower California peninsula.

Of the fifty-nine species here defined, not quite all are new, two or three of them having been indicated somewhat recently by Dr. Small and Mr. Heller, these belonging to the Texan district.

Among the new ones are several of very recent detection in Mexico, having come to hand only after this paper was nearing completion. One of these was distributed by Mr. Pringle under the name Dr. Rose had assigned it. The others Dr. Rose had himself collected and determined to be new. He has chosen that these should all be incorporated into this monograph, rather than give them separate place among his own miscellanies of Mexican botany.

SYNOPSIS OF THE SPECIES.

TWIGS when not velvety-hoary either chestnut-colored or darker, never whitish or straw-colored.

Upper face of foliage more or less definitely bluish-green or glaucescent, never clear bright green.

Leaves in maturity thin, or thinnish, never hard and subcoriaceous; samaras in all these very large, thin and plane, the wing ample, the body small in proportion.

Leaflets dark, scarcely bluish-green, not glaucous, only lighter beneath, glabrous, odd one obovate to long-ovate, 9 cm. long; samaras suborbicular, 2 cm. long, nearly as wide. 1. *P. aquilina.*

Leaflets definitely blue-green on both faces, nearly glabrous, odd one ovate, 5 cm. long; samaras suborbicular, retuse at base, obcordate at summit. 2. *P. isophylla.*

Leaflets dull with pubescence above, even more so beneath, odd one broadly obovate, 4 cm. long; samaras suborbicular, 1.5 cm. long, sharply wrinkled and with longitudinal sharp ridge. 3. *P. prominula.*

Leaflets dull and pubescent, odd one elliptic-obovate, 6.5 cm. long; samaras round-oval, 2.5 cm. long, sharply wrinkled, but with no median ridge. 4. *P. wrightiana.*

Leaflets pale, gray-green with pubescence, odd one obovate-elliptic, 5 cm. long, of firmer texture; large samaras broadly somewhat obovate, obtuse, 3 cm. long, obtusely wrinkled and much dotted. 5. *P. antonina.*

Leaflets less pubescent, bluish-green only when young, very firm when mature, odd one broadly obovate, 7 cm. long, cuspidate-pointed; samaras suborbicular, 3 cm. long, subcordate. 6. *P. rhombifolia.*

Leaflets very pale, beneath whitish with bloom, large, odd one oval to obovate, 7 cm. long, acutish; samaras small for the foliage, 2 cm. long, obtuse at base, at apex emarginate. 7. *P. formosa.*

Leaflets very pale, whitish beneath with bloom, almost so above, small, firm, odd one broadly rhombic-lanceolate, 4.5 cm. long; samaras large for the foliage, rounded, but truncate at both ends. 8. *P. villosula.*

Leaflets pale, whitish beneath with bloom and white down, odd one ovate, 5 cm. long, obtuse, crenate; samaras orbicular, 1.5 cm. long and wide. 9. *P. tortuosa.*

Leaflets glaucous on both faces, tomentulose beneath, odd one ovate-elliptic, 5 cm. long, subentire; samaras broader than long, with cordate lobes at each end, the breadth 2 cm. 10. *P. subintegra.*

- Leaves in maturity of harder, firmer texture, approaching the coriaceous.
  - Samaras large, the wing as broad as the body or broader.
    - Leaflets glabrous, glaucous on both faces, odd one narrowly cuneate-obovate, 4.5 cm. long, subentire; samaras orbicular, 2 cm. long and broad. 11. *P. coahuilensis.*
    - Leaflets with traces of pubescence, dark blue-green above, pale beneath, odd one 3 to 4 cm. long, round-obovate, very obtuse; samaras round-oval, 1 to 3 cm. long. 12. *P. obtusata.*
    - Leaflets very small, of like pale blue-green and scantily hairy on both faces, odd one barely 1.5 cm. long, oblong-obovate, obtuse; samaras larger than the foliage, suborbicular, the larger 2 cm. long. 13. *P. pumila.*
    - Leaflets not pale except beneath, hardly even subcoriaceous, odd one ovate or rhombic-ovate, 4 to 5 cm. long, acute, crenulate; samaras subquadrate-obovate, 2 cm. long, lobed at base and summit. 14. *P. scutellata.*
    - Leaflets colored as in the last, lanceolate, 6 cm. long; samaras broadly ovate-cordate, 2 cm. long, cuspidate at apex. 15. *P. cuspidata.*
    - Leaflets of dark only faintly bluish green above, pale beneath, odd one broadly lanceolate, 6 cm. long, acute; samaras suborbicular, 2 cm. long and wide, the broad wing not flat but full and crisped. 16. *P. undulata.*
    - Leaves glabrous, blue-green above, whitish beneath, odd one 5 cm. long, ovate-elliptic, acute; samaras subquadrate-oval, the longest 2 cm. long, subtruncate at both ends. 17. *P. cognata.*
  - Samaras smaller as a whole, the body and wing of equal breadth.
    - Leaves bluish-green and much punctate above, glaucescent beneath, odd one ovate or obovate, 6 cm. long, crenate; samaras orbicular, 1.5 cm. long and wide. 18. *P. crenata.*
    - Leaves dull blue-green above, glaucous and puberulent beneath, odd one lance-obovate to lance-rhombic, 4 to 5 cm. long, acute, crenate; samaras 1.2 to 1.4 cm. long, round-obovate, acutish at base. 19. *P. jucundu.*
    - Leaflets glaucescent and along the veins slightly villous as to both faces, odd one broadly obovate and acute, 4 cm. long; small, obovate, 1 to 1.5 cm. long. 20. *P. sancta.*
    - Leaflets deep blue green above, glaucous beneath, nearly glabrous, odd one ovate or

obovate, 2–3 cm. long, acute, subentire; samaras very small, suborbicular, 1 cm. long. 21. *P. parvula.*

Samaras not so small (except in No. 22), but body in all large in proportion, and broader than the average breadth of the wing.

Leaflets strongly glaucous on both faces, small petiolulate, lanceolate, crenulate, 4 cm. long; samaras orbicular, 1.5 cm. broad, emarginate. 22. *P. glauca.*

Leaflets light scarcely bluish green above and punctate, pale and villous beneath, odd one cuneate-obovate, 4 cm. long, obtuse; samaras round-obovate, 1.5 cm. long, emarginate. 23. *P. monticola.*

Leaflets dark blue-green, glaucous beneath, glabrous, odd one 7 cm. long, ovate-rhomboid, acute, doubly serrate-dentate; samaras round-obovate, 2 cm. long. 24. *P. betulifolia.*

Leaflets as in 24 in all but the outline, being narrow, lancelate, 7 cm. long; samaras oval, often 3-winged, remarkably smooth. 25. *P. attrita.*

Leaflets of a deep scarcely bluish green above, very pale beneath with bloom and a fine pubesence, odd one rhombic-lanceolate, 6 cm. long; samaras broadly ovate or oval, acutish, at base truncate. 26. *P. similis.*

UPPER FACE of foliage light-colored, never deep bluish green, in a few species glaucescent, in most of a clear bright green; samaras in all with broad wing.

Leaves in maturity hard and subcoriaceous.

Leaflets strongly gland-dotted, odd one 6 cm. long, ovate-elliptic, acute at base, blunt at apex; samaras round-obovate, 1.5 cm. long, retuse. 27. *P. polyadenia.*

Leaflets less notably dotted, odd one 7 cm. long, narrow-obovate, acutish; samaras nearly orbicular, 1.7 cm. long. 28. *P. aboriginum.*

Leaflets nearly dotless, light green and polished above, 5 cm. long, obovate, obtuse; samaras 2 cm. broad, not as long. 29. *P. lucida.*

Leaflets fine-dotted, deep green and polished, odd one cuneate-obovate, 5 cm. long, crenate, obtuse or retuse. 30. *P. toxicodendron.*

Leaflets lance-elliptic, 5 cm. long, subequal, long-pointed, subentire; samaras orbicular, 2 cm. broad, much dotted. 31. *P. persicifolia.*

Leaflets dull with a short soft pubescence, odd one 5 cm. long, elliptic-lanceolate, very acute; samaras suborbicular, 1.7 cm. long, not as broad, not much dotted. 32. *P. subvestita.*

Leaves in maturity only firmly membranaceous, at earlier stage very thin.

Leaflets rich deep green above, pale-tomentulose beneath, odd one 6 cm. long, broad-lanceolate, acute; samaras round-oval, 2 cm. long. 33. *P. padifolia.*

Leaflets bright light green above, pale beneath, odd one lance-rhomboid, 6 cm. long, acutish;

samaras broad-orbicular, 2 cm. wide, not as long, retuse at both ends. 34. *P. neo-mexicana.*

Leaflets subequal, paler beneath with fine hairs; odd one lance-elliptic, 7 cm. long, very acute, entire; samaras only 1.5 cm. broad, the length less, retuse at apex. 35. *P. acutifolia.*

Leaflets of a bright almost shining green, only lighter beneath, odd one 9 cm. long, broadly elliptic, cuspidately acute; samaras 3 cm. long, a trifle wider, orbicular, subcordate, and obcordate. 36. *P. megacarpa.*

Leaflets light clear green above, paler and yellowish beneath, odd one 5 cm. long, lanceolate, hardly acute; samaras orbicular, 5 cm. across, truncate at base, at apex emarginate. 37. *P. laetissima.*

TWIGS almost always glabrous, never chestnut-brown, in a few cinnamon-reddish, in most straw-colored or whitish and shining. Foliage never dark, both faces usually yellow-green (almost the hue of orange or lemon leaves).

Leaves in maturity subcoriaceous or almost coriaceous.

Leaflets strongly dotted, slightly pubescent, odd one ovate, 5 cm. long, blunt at apex, and emarginate; samaras orbicular, 1.5 cm. across. 38. *P. verrucosa.*

Leaflets much less dotted, glabrous, odd one obovate, 5 cm. long, acutish; samaras suborbicular, 1.7 cm. across. 39. *P. ambigens.*

Leaflets glabrous, coarsely dotted above, pale beneath, odd one rhombic-lanceolate, 4.5 cm. long, acute, subentire; samaras subcordate-ovate, 1.5 cm. long. 40. *P. nitens.*

Leaflets glabrous, size and form as in the last, but pale with bloom and almost dotless; samaras orbicular, nearly 2 cm. across. 41. *P. pallida.*

Leaflets hardly subcoriaceous, almost dotless, odd one obovate, 6 cm. long, obtuse, crenate; samaras large, 2 cm. broad, not as long, cordate and obcordate. 42. *P. straminea.*

Leaflets small, yellow-green on both faces and glabrous, punctate, odd one ovate-lanceolate, 3.5 cm. long; samaras all triquetrous. 43. *P. nitida.*

Leaflets glabrous, much punctate, size and form as in the last, but beneath silvery-lustrous; samaras triquetrous. 44. *P. argentea.*

Leaflets dull yellow-green on both faces and much punctate, odd one lanceolate, 4 cm. long, obtuse; samaras large, broadly oval, 2 cm. long. 45. *P. neglecta.*

Leaflets small, narrow-lanceolate, acute, hardly 4 cm. long, wholly yellow-green; samaras large for the leaves, triquetrous. 46. *P. triptera.*

Leaflets larger, narrow-lanceolate, odd one 6 cm. long; samaras large, flat, suborbicular, 2 cm. wide, rounded at both ends. 47. *P. lutescens.*

Leaflets truly lanceolate, much dotted, odd one 7 cm. long; samaras 2.2 cm. wide, cordate and obcordate. 48. *P. elegans.*

Leaflets rhombic-lanceolate, only 3.5 cm. long; samaras orbicular, 1.6 cm. across, retuse at base, at apex cuspidate-acute. 49. *P. confinis.*

Leaves in maturity thinner, hardly firmer than membranaceous, long and very narrow.

Leaflets narrow-lanceolate, odd one 8 cm. long; samaras subreniform-orbicular, nearly 2 cm. wide. 50. *P. saligna.*

TWIGS never whitish, usually cinnamon-colored or darker at the end of the first season; leaves of a peculiar rather deep but dull green, much the same on both faces, never bluish-green or glaucous, the venation in all singularly divaricate and the veinlets colorless and obscure; samaras in most with a narrow wing and broader body, in a few wingless, thick and nut-like.

SAMARAS conspicuously but rather narrowly winged.—All Californian.

Leaflets oblong-lanceolate, lightly crenulate, 5 cm. long; smaller samaras orbicular, longer round-obovate, 2 cm. long, body very little broader than the wing. 51. *P. brevistylis.*

Leaflets of rather vivid green, oval, ample, subequal, the odd one 7 cm. long, 4 broad; samaras subreniform-orbicular, 1.7 cm. broad, 1.4 cm. long, body notably wider than wing. 52. *P. ovalifolia.*

Leaflets thin, rather light green, odd one 5 cm. long, obovate-oblong; samaras round-obovate, subulate-pointed. 53. *P. cinnamomea.*

Leaflets cuneate-obovate, odd one 4 to 7 cm. long, crenulate; samaras orbicular, 1.5 cm. across, body twice as wide as wing. 54. *P. crenulata.*

Leaflets elliptic-lanceolate, 6 cm. long, subserrulate; samaras orbicular or a trifle longer, abruptly acute, 1.5 cm. long; body much wider than wing. 55. *P. bullata.*

Leaflets oblong-lanceolate, obtuse, 5.5 cm. long, crenulate; samaras orbicular, perfectly so, 1.5 cm. wide, body twice the width of the wing. 56. *P. cycloloma.*

SAMARAS thick, nut-like, being wingless, or one species with trace of wing.—All Lower Californian.

Leaflets very small, narrowly obovate-oblong; samaras oval, 2 cm. long, encircled by a very narrow and only keel-like wing. 57. *P. nucifera.*

Leaflets not so small; samaras oval, 2 cm. long, neither winged nor keeled. 58. *P. obscura.*

Leaflets very small; samaras round-ovate, only 1 cm. long, wingless. 59. *P. aptera.*

DESCRIPTIONS OF THE SPECIES.

1. **Ptelea aquilina,** sp. nov.

Twigs of the season dark red-brown, glabrous, lightly rugulose and glandular: leaves thin, of a rich deep green above, paler but not glaucescent beneath, glabrous on both faces; odd leaflet ovate-elliptic, 6 to 9 cm. long, obtusely short-pointed, rather remotely subserrate-crenate, the pair one-third smaller, more oval, slightly inequilateral: samara not large for the foliage, little more or less than 2 cm. long, broadly round-obovate, abruptly acutish, the base now and then retuse; body broadly oval, of less than the width of the wing, indistinctly circumvallate, very definitely transverse-rugose, notably glandular; style and stipe prominent, the latter longer.

Said to be common along the White River near Eagle Rock, in extreme southwestern Missouri, where it was collected June 21, 1897, by B. F. Bush, his no. 171 as in National Herbarium. One would expect it in adjacent Arkansas.

✓ 2. **Ptelea isophylla,** sp. nov.

Twigs of the season light chestnut-color, glabrous, sharply rugose, obscurely glandular, the older dark brown, smooth: leaves thin, of a light dull glaucescent-green on both faces and both with traces of pubescence, only the upper minutely and inconspicuously gland-dotted; odd leaflet ovate to rhombic-ovate, 4 to 6 cm. long, abruptly obtuse-pointed, subentire, the pair seldom smaller, sometimes even larger, relatively broader, scarcely inequilateral: samara very large for the foliage, 2 to 2.5 cm. long, nearly as wide, suborbicular but with obcordate summit and subcordate base; body round-oval, of less than the width of the wing, circumvallate, the transverse rugosity close but low and not very distinct, the whole only obscurely gland-dotted; stipe nearly twice as long as the style, both slender.

Known to me only as collected by Mr. B. F. Bush, June 8, 1898, from woods in the vicinity of Swan, Missouri. The type sheet in the National Herbarium has Mr. Bush's no. 211. The species is next of kin to my *P. mesochora* of the upper Mississippi region.[a]

3. **Ptelea prominula,** sp. nov.

Perhaps a low or small shrub, the twigs small, with short internodes and pubescent: leaves small, dull-green, pubescent beneath, less so above; odd leaflet broadly obvoate, 4 to 4.5 cm. long, 2 to 2.5 cm. wide above the middle, all subentire, very shortly cuspidate at apex, the pair of laterals not much smaller, round-ovate: samaras suborbicular, small, 1.5 to 1.7 cm. long, very nearly as broad, subcordate at base, retuse at apex, the body of about the width of the wing, faintly dotted but strongly and prominently transverse-rugose and circumvallate, the reticulation of the wing unusually elevated and prominent, as also the subequal style and stipe, even these connected by a sharp ridge pervading whole length of the body of the fruit.

Known to me in but a single twig in mature fruit, purporting to have been collected on a creek bank near Austin, Texas, May 9, 1872, by Elihu Hall, the label bearing his distribution number, 74; but on the same sheet in the National Herbarium, and under the same label, occur two other twigs, both of *P. rhombifolia*, and with fruit very young, not half grown.

The wing of *P. prominula* is wavy rather than plane, and the elevated character of the wrinkles and reticulations is peculiar.

✓ 4. **Ptelea wrightiana,** sp. nov.

Twigs of the season short, slender, pubescent, and regulose: leaves not small, very thin, dull bluish-green, finely but scantily pubescent on both faces; middle leaflet elliptic-obovate, 5 to 8 cm. long, the pair obliquely ovate, only half as large, all merely acutish, subentire: samaras very large, round-oval, 2.5 cm. long, 2.2 wide, obtuse at both ends; body round-oval, of much less than the width of the wing, not obviously either punctate or circumvallate, but the transverse wrinkles sharply prominent, as also the reticulation of the wing; style and stipe equal, both very long, rather prominent.

Turkey Creek, western Texas, June, 1849, Charles Wright, no. 82 as in the National Herbarium. Referred to in Gray, Plantæ Wrightianæ.[b]

I also refer here provisionally a sheet of specimens collected by Jermy in western Texas, near San Antonio. It has similar fruits, the foliage differing in that it is of firmer texture, and the outline of leaflets narrow, being elliptic-lanceolate. The label bears no date.

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[a] Torreya 5: 100. 1905.

[b] Part 1, p. 31.

5. **Ptelea antonina,** sp. nov.

Twigs of the season not perceptibly rugose or tuberculate, being hoary with a dense hirtellous-tomentose indument, the older dark dull-brown, smooth and glabrate: foliage at all stages of a definitely blue-green shade, also villous-pubescent beneath, deeper in color and thinly pubescent above, the texture thinnish even in maturity; middle leaflet obovate to obovate-elliptic, 4 to 6 cm. long, acute at base, obtusely cuspidate pointed at apex, faintly crenate or subentire, the pair smaller by one-fourth to one-third, obliquely and even broadly ovate rather than ovate, pointed like the odd one, all sessile: samaras of the largest, even extremely large in proportion to the foliage, 2.5 to 3 cm. long, 2.1 cm. wide above the middle, broadly somewhat obovate, obtuse at the broad apex, mucronulate by the short style, at base narrow, retuse; body oval, of somewhat less than the width of the wing, circumvallate, closely and rather sharply transverse-rugose, only minutely and somewhat obscurely though not sparingly glandular-punctate; style and stipe long and subequal, but neither prominent.

Near San Antonio, Texas, the type specimens in the National Herbarium, collected June 11, 1891, by Mr. L. H. Dewey. In 1894 A. A. Heller collected the same also at San Antonio, but in flower and half-grown leaf only. He distributed it under the same number, 1582, as that which accompanies his *P. rhombifolia*, though the two species are not so very closely related, the foliage of *P. rhombifolia* being not only almost twice as large, but of almost subcoriaceous texture.

6. **Ptelea rhombifolia** Heller, Bull. Torr. Club **26**: 313. 1899, in small part only.

Twigs of the season light brown, minutely and densely pubescent, but the indument parted into interrupted lines as following the summits of the pronounced rugosities: leaves large, rather firm in maturity, of a deep green, above sparingly clothed with short depressed hairs, beneath villous-tomentulose; odd leaflet broadly obovate, rarely with some hint of the rhomboid in outline, 6 to 8.5 cm. long, 4 to 4.5 wide above the middle, acute at base, briefly and bluntly cuspidate at apex, laterals smaller by one-fourth or one-third, obliquely ovate, cuspidate: samaras very large, suborbicular, 2.5 to 3.2 cm. long, the breadth but little less, slightly subcordate at the broad base, the rounded or subtruncate apex rarely mucronately or cuspidately acutish; body large, but of less than the width of the broad wing, round-obovate, indistinctly circumvallate, closely but not prominently transverse-rugose, faintly dotted; stipe longer than the style and both long.

Southwestern Texas, where it seems to be common, especially about San Antonio. It was gathered there in immature specimens by Heller in April, 1894; the fruit wrongly characterized by him because not half grown in his specimens. Better material is in the National Herbarium from Dr. E. Palmer, 1879; Munson and Hopkins, near Kerrville, July, 1889; William R. Maxon, at Victoria, April 28, 1905. Mr. Heller's distribution number, 1582, covers this, and also the very different *P. antonina*, above described as new.

7. **Ptelea formosa,** sp. nov.

Shrub perhaps large; twigs of the season large, copiously leafy with large foliage, the bark reddish-brown, seeming glabrous but under a lens minutely hirtellous-puberulent, only minutely and obscurely rugulose and glandular, the older glabrous, smooth, cinereous-gray: leaves large, thin, pale on both faces, above glabrous except on the veins, beneath very glaucous and with scattered villous hairs not only on the veins but elsewhere; leaflets subequal, the terminal one as often smaller as larger than the other two, obovate to oval, 6 to 8 cm. long, only abruptly narrowed at base, all abruptly and cuspidately acute, the margins more or less distinctly subserrate-toothed: samaras not large for the foliage, the largest 2 cm. long, little more than

1.5 cm. wide, varying from orbicular toward ovate, only obtuse at base, the apex emarginate; body oval, both large and thick in proportion to the wing, the width of the two about equal, neither circumvallate nor the ridges running crosswise, but mostly broken into reticulation, gland-dots mostly few and rather obscure; style also quite obscure, longer than the stipe, this more obvious.

Sierra Blanca, New Mexico, August 17, 1897, at 2,120 meters, collected by E. O. Wooton and by him distributed under no. 657, at least as in my herbarium, where the only specimens known to me are preserved. It is manifestly allied rather closely to *P. villosula* of the Organ Mountains, but has a very different thin, large, and handsome foliage, the leaflets recalling the leaves of the choke cherry, but thinner and paler on both faces. I suppose by the foliage that its habitat must be in deep shaded canyons, where the air is moist from the spray of streams.

8. **Ptelea villosula,** sp. nov.

Twigs of the season slender, chestnut-color, almost or quite glabrous, short-rugulose and tuberculate, those a year old not very different: leaves quite firm, membranaceous but not subcoriaceous, glaucescent above and nearly glabrous, beneath whitened by bloom and a white villous short pubescence; odd leaflet broadly rhombic-lanceolate or ovate-lanceolate, tapering to both ends but acute at neither, crenulate, the length 4 to 5 cm., the pair smaller by one-third to one-half, and varyingly inequilateral: samaras large in proportion to the foliage, 1.2 to 1.8 cm. long, almost as broad, usually subquadrate-orbicular, being broadly truncate at both ends; body neither large nor thick as compared with the wing, oval, coarsely and more or less transversely rugose, with or without a trace of circumvallation, the gland-dots few, coarse; style and stipe equal, short, neither one conspicuous.

Known only from the isolated Organ Mountains of southern New Mexico, as collected July 11, 1897, by E. O. Wooton, who distributed excellent fruiting specimens under no. 134, as in my herbarium (type) and the National Herbarium.

From the small size and rather firm texture of the foliage I infer this to be an inhabitant of no closed and shady canyon, but of the open slopes or summits of the mountains; but the collectors never vouschafe the least information upon these important matters.

9. **Ptelea tortuosa,** sp. nov.

Twigs and branches short, rigid, tortuous, those of the season smoothish, puberulent, the older dull dark brown, glabrate: mature foliage quite firm but not subcoriaceous, pale-green, glabrate and punctate above, glaucus and whitish-tomentulose beneath; odd leaflet 3.5 to 6 cm. long, ovate above a short tapering base, hardly acute at apex, lightly and unevenly crenate; the pair variously smaller, obliquely oval, obtuse at both ends, more distinctly crenate, all sessile: samara suborbicular but broader than long, the width 1.5 cm., broad and subtruncate at both ends; body round-oval, nearly central, not circumvallate, about as wide as the wing, ridges low, more or less transverse and unbroken, gland-dots obvious only under a lens.

Northern Arizona, in the San Francisco Mountain Forest Reserve, J. B. Leiberg, August 10, 1901, no. 5822 as in the National Herbarium.

The type specimens have the appearance of a low shrub of poor and arid soil. But from the same neighborhood there are before me two sheets, one by Mr. Heller, the other from Dr. McDougal, both young and immature fruit, which have the appearance of a different species; and in the first draft of this paper I had named and described them as such. The leaves are broader, larger, thinner, less pubescent beneath, etc., but they may possibly represent *P. tortuosa* as grown in a shady canyon, under the influence of an atmosphere less arid. Future research must lead to the settlement of such questions. The pubescence of the lower face of the leaves in all these has the peculiarity of seeming to be stellate or dendroid; but I think this comes about by a crossing of the hairs in tufts, rather than by an actual branching.

10. Ptelea subintegra, sp. nov.

Twigs of the season pubescent, hardly regulose, the older and glabrate branches very dark brown and nearly smooth: foliage extremely pale on both faces, glaucous and with sparse pubescence above, almost white beneath with both bloom and villous-tomentulose indument, texture no thicker than membranaceous; middle leaflet ovate-elliptic, 4 to 5 cm. long, the pair nearly as large, obliquely ovate, all sessile, subentire, scarcely acute: samaras of middle size, much broader than long, the breadth 2 cm., the length 1.5 cm., cordate at base, obcordate at summit; body round-obovate, of much less than the width of the wing, not circumvallate, the transverse ridges few, broad and low, dots few but obvious; style and stipe equal and short.

A fine species known only from somewhere in the vicinity of Durango, Mexico, where it was gathered byDr. E. Palmer in 1896, the label of the type specimen in the National Herbarium bearing the collector's number 846.

11. Ptelea coahuilensis, sp. nov.

Twigs of the season glabrous, chestnut-color, densely glandular-verrucose, the older less prominently so, but color the same: leaves small, subcoriaceous, glabrous, glaucous on both faces, most so beneath, and there with but the faintest trace of punctuation; odd leaflet 4 to 5 cm. long, narrowly cuneate-obovate and obtuse to rhomboid and acutish, subentire to quite crenulate, the pair one-half to two-thirds as large, otherwise similar, few being notably inequilateral: samaras large, orbicular, 2 cm. in length and breadth, seldom emarginate at either end; body oval or suborbicular; of much less than the width of the wing, the transverse ridges broad, low and obscure; style longer than the stipe.

Specimens seen only from the State of Coahuila, Mexico, the typical being Pringle's number 1937, collected in July, 1888, as found in the National Herbarium. The sheets of the same collection in the Herbarium of John Donnell Smith are exactly like it. Palmer's 391 in the National Herbarium, from San Lorenzo Canyon near Saltillo I take to be in part the same, though with broader and crenate foliage, and with several of the large samaras three-winged. But there is a very different species mixed with this under that number, 391 of Dr. E. Palmer.

12. Ptelea obtusata, sp. nov.

Twigs and branches stouter and rigid, as well as densely leafy and fructiferous, during the first season grandular, warty, and pubescent: leaves almost coriaceous, dark blue-green above, glaucescent beneath, with traces of short scattered hairs on both faces, and punctuation almost obsolete; odd leaflet 3 to 4 cm. long, very broad above an abruptly attenuate base, the outline from round-obovate very obtuse, to rhomboid-ovate, a finely crenulate margin at length revolute, the leaflet thus seeming entire, the pair similar but of all sizes: samaras large, round-oval, 1.2 to 1.5 cm. long, the breadth notably less, obtuse at both ends; body large in proportion and much elongated, long-oval, of almost or quite the width of the wing, broadly low-rugose transversely and somewhat circumvallate, dots most obscure; style and stipe equal, and both short.

Known to me only as collected somewhere in Coahuila, Mexico, in 1880, by Dr. E. Palmer, his no. 146 as in the National Herbarium.

13. Ptelea pumila, sp. nov.

Evidently dwarf, the very short twigs of the season tuberculate, puberulent, leafy with small leaves, the flowers few, some solitary: leaves greatly reduced, pale and alike glaucous on both faces, also with traces of minute hairiness; odd leaflet oblong-obovate, very obtuse, barely 1.5 cm. long, the pair half as large, oval, all subentire: samaras larger than the leaves, mostly orbicular and nearly 2 cm. long and broad, subcordate at base, the obtuse summit conspicuously mucronate by the long protruding style-tip; body of less than the width of the wing, the coarse, low wrinkles somewhat radiating from its center.

State of Coahuila, Mexico, known in a single specimen (National Herbarium), obtained by Dr. E. Palmer, in 1904, mixed with his no. 391, which is otherwise referred to *P. coahuilensis*.

14. Ptelea scutellata, sp. nov.

Twigs of the season rugulose, puberulent, the older glabrate, nearly smooth: leaves subcoriaceous, deep blue-green above and glabrous, beneath glaucescent and obscurely puberulent; middle leaflet 4 to 5 cm. long, ovate to rhombic-ovate and elliptic-lanceolate, acute, crenulate, laterals remarkably small, seldom more than half as large, only slightly inequilateral and always narrow: samaras subquadrate-obovate to suborbicular, the more elongated 2 cm. long, the narrow base subcordate, the broad apex obcordate, or at least retuse; body round-oval, not as wide as the average width of the wing, rugose-reticulate and impressed-punctate, not circumvallate; stipe prominent, style of equal length but obscure.

Santa Eulalia Mountains, Chihuahua, Mexico, C. G. Pringle, October 2, 1886, his no. 940, as in National Herbarium. The specimens are in ripe fruit of a former season, or else of the spring preceding, while at the October date of collecting full clusters of flowers were in process of expansion.

In the Herbarium of John Donnell Smith is a specimen from the same mountains, collected by E. Wilkinson, in 1885, in the month of March, which is laden with mature foliage and fruit as from the autumnal flowering.

15. Ptelea cuspidata, sp. nov.

Twigs of the season chestnut color, puberulent, the older glabrate, all rugulose: leaves subcoriaceous, glabrous, bluish-green above, glaucous beneath, moderately punctate; odd leaflet lanceolate, 5 to 7 cm. long, acute or obtusish, evenly crenulate, the pair of the same shape and from almost as large to barely one-third smaller, all sessile: samaras broadly ovate-cordate to suborbicular, 2 to 2.3 cm. long, the width the same, the base cordate or subcordate, the apex broadly and bluntly cuspidate, also mucronulate by the short free portion of the style; body oval, much narrower than the average width of the wing, coarsely and not prominently transverse-rugose and rather closely punctate; stipe very short, style three times as long.

Santa Eulalia Mountains, Chihuahua, March 1, 1885, E. Wilkinson, in mature foliage and fruit as from an autumnal flowering. Allied to *P. scutellata*, like it in color and texture of foliage; both leaflets and fruits of different character. The only specimens seen are in the National Herbarium, sheet 130319.

16. Ptelea undulata, sp. nov.

Shrub 4 m. high, with glabrous twigs almost verrucose-glandular and rugulose: leaves subcoriaceous, nearly or quite glabrous, dull dark blue-green above, glaucescent beneath, densely puncticulate on both faces; middle leaflet elliptic or even somewhat rhombi-lanceolate, acute, 6 cm. long, obscurely and unevenly crenulate, the laterals similar and not much smaller: samaras suborbicular, 2 cm. long and broad, not flat, the broad wing being full and somewhat ruffled; body oval, circumvallate, the strong rugosity mostly broken into a reticulation inclosing many and prominent gland-dots; stipe very short, style long, neither prominent.

Probably of the Burro Mountains, southern New Mexico; Rusby's 111 as in the National Herbarium, gathered July 17, 1880.

17. Ptelea cognata, sp. nov.

Twigs of the season chestnut-color; glabrous and polished, warty-rugose, the short ridges surmounted by a large gland: leaves on unusually long and slender petioles, subcoriaceous, of a deep, slightly bluish-green above, very glaucous beneath, glabrous on both faces; middle leaflet ovate-elliptic, acute, subserrate-crenate or subentire, 3.5 to 6 cm. long, the laterals similar, often quite as large, oblique-ovate or else almost equal-sided and ovate: samaras orbicular to subquadrate-oval, the largest nearly 2 cm. long and elongated, the smaller about 1.5 cm. and orbicular; body large, oval, deeply and coarsely pitted, rather than transverse-rugose, gland dots few but not obscure; stipe very short, style quite long.

Fort Huachuca, Arizona, September, 1891, T. E. Wilcox; type in National Herbarium. Species allied to the foregoing, as indicated by the coriaceous blue-green foliage, but specifically well marked by its total lack of pubescence, long slender petioles, and unusually warty twigs.

18. **Ptelea crenata,** sp. nov.

Twigs bright chestnut-color and glabrous, more glandular-tuberculate than rugose: leaves bluish-green and strongly punctate above, glaucescent beneath, with traces of pubescence on both faces and in texture fairly subcoriaceous; odd leaflet ovate, not inclining to rhomboid, 4.5 to 6 cm. long, rather obtuse at apex, at base acute but sessile, the pair oval, but obliquely so, much or little small, all distinctly crenate: samaras small for the foliage, nearly orbicular, 1.5 cm. wide, not quite as long, the apex being retuse, the base truncate; body orbicular, its width rather greater than that of the wing, not circumvallate, the ridges low and irregular but coarse, dots obscure and few; style and stipe both short, subequal.

In some part of northern Arizona south of Flagstaff, J. W. Toumey, September, 1894. Allied to the last two, but not to be confused with either. Type in the herbarium of the California Academy of Sciences.

19. **Ptelea jucunda,** sp. nov.

Twigs of the season chestnut-brown, tuberculate, minutely and only sparsely pubescent, the older glabrate, dark, polished: leaves subcoriaceous, dull blue-green above, merely glaucescent beneath, everywhere sparsely and obscurely pubescent; middle leaflet lance-obovate or in some cuneate from the middle, 4 to 5 cm. long, obtusish to very acute, subentive or crenate, the pair not much smaller, obliquely ovate or oval, all sessile: samaras round-obovate, rather small, 1.2 to 1.4 cm. long, acutish at the narrowed base, commonly emarginate at summit; body round-oval, of the width of the wing, coarsely and irregularly rugose, lightly circumvallate, notably punctate; style and stipe equal.

San Luis Mountains, on the Mexican boundary line, Arizona, June 25, 1892, E. A. Mearns, no. 383, as in the National Herbarium. A handsome species with glossy chestnut-colored twigs and branches, rich green perhaps persistent foliage, and smallish but elegant samaras.

20. **Ptelea sancta,** sp. nov.

Mature twigs of the season chestnut-color, short, rugulose, glabrous or with minute scattered hairs, the older like them but glabrous: leaves small, glaucescent on both faces and small-dotted, midvein and veinlets slender and whitish, a scanty minute histellous hairiness along them, the leaf margins unevenly crenate; odd leaflet broadly oborate above and abrupt cuneate base, varying to rhomboid-ovate, obtuse or acutish, 3.5 to 4.5 cm. long, 2 to 2.5 wide above the middle, the pair smaller by less than one-third, very inequilateral: samaras of the smallest, round-obovate or subpyriform in outline, 1 to 1.5 cm. long; body large in proportion to the twig, oval or obovoid, with broad and low not very definitely transverse rugosity; style and stipe subequal, both short.

San José Mountains, Sonora, Mexico, August 3, 1893, Dr. E. A. Mearns, U. S. Army; species well marked and not otherwise known. Type in the National Herbarium.

21. Ptelea parvula, sp. nov.

Apparently a low gnarled shrub, the older branches short, stout, knotted, ash-gray, glabrate, the very short twigs of the season reddish and tomentulose: leaves subcoriaceous, small, dull pale-green above and with some pubescence along the veins, whitish beneath with bloom and also a thin white tomentulose pubescence; odd leaflet ovate or obovate, only 2 to 5 cm. long, the pair not much smaller, all acute, subentire: samara very small, suborbicular, about 1 cm. long, the width a mere trifle less, the whole very thick and firm; body oval, not prominently elevated above the surface of the wing, and like it coarsely reticulate rather than definitely rugose, the dots obscure.

Summit of the Sierra Blanca, southern New Mexico, August 1, 1897, E. O. Wooton, his number 658 as in my set of his plants; but with no note of size or special location other than that of the altitude of 6,300 feet, which is about that of the summit.

22. Ptelea glauca, sp. nov.

Shrub 3 meters high, all twigs and younger branches glabrous, nearly smooth, chestnut-color: leaves numerous, small, quite firm but hardly subcoriaceous, very glaucous on both faces, very sparingly pubescent beneath, leaflets almost equal, all conspicuously petiolate, about 4 cm. long, lanceolate, obtuse or acute, crenulate: samaras orbicular, the largest 1.5 cm. broad and long, emarginate; body round-oval, broader than the width of the wing, strongly and usually transversely rugose, lightly circumvallate; style and stipe equal, both very short.

Elegant and very peculiar species known only as obtained somewhere in southwestern Chihuahua in 1885, by Dr. E. Palmer; his distribution number 152 as in the National Herbarium.

23. Ptelea monticola, sp. nov.

Twigs of the season dull-brown, velvety-puberulent, the older glabrate and darker: leaves subcoriaceous, light green and strongly punctate above, beneath glaucescent and slightly villous as well as plainly punctate; odd leaflet broadly cuneate-obovate, 3.5 to 5 cm. long, obtuse or retuse, the pair not much smaller, very obliquely ovate, all lightly crenate, but the crenatures at length becoming obscure by revolution of the whole margin: samaras not large, round-obovate, 1.5 cm. long, of about the same breadth above the middle, the base abruptly acutish, the apex slightly emarginate or scarcely more than truncate; body large, thick, broader than the widest part of the wing, round-obovate, strongly rugose, lightly circumvallate, obscurely dotted.

Summit of the Guadalupe Mountains, western Texas, August, 1881, Dr. V. Havard; a single but full sheet of specimens in the National Herbarium. The species is probably local, for the Guadalupe Mountains are completely isolated, yet our shrub bears marks of affinity for *P. polyadenia*, the habitat of which is the banks of the Canadian River, 300 miles to the northward. Its foliage, however, is very different, and the samaras differ both in outline and markings.

24. Ptelea betulifolia, sp. nov.

Twigs of the season chestnut-color, roughened with short narrow gland-tipped ridges, glabrous and almost shining, even those of the second season as bright in color and white-dotted: mature leaves firm, hardly subcoriaceous, bright green and almost glabrous above, as nearly glabrous beneath but pale and glaucescent; odd leaflet 4 to 10 cm. long, usually ovate-rhomboid or almost rhombic, acute at both ends, but at base tapering to a short but definite petiolule, the pair smaller by one-third, obliquely rhomboid-oval, being notably inequilateral, all distinctly and doubly serrate-toothed: samaras round-obovate, 1.6 to 1.8 cm. long, usually abruptly narrowed at base and cuspidately acute at apex, or at least mucronate by the short style; body round-oval, more or less circumvallate and coarsely low-rugose, the ridges more or less confluent into a pitted reticulation and sparsely and faintly dotted, the whole large in proportion to the wing; style and stipe about equal, both prominent.

In various mountain ranges along the Mexican border in southern Arizona; the best type from Fort Bowie, May, 1894, collected by A. K. Fisher. Vigorous branches with the largest of foliage and immature fruit are from Fort Huachuca, by Dr. E. Palmer, 1898, no. 428; both these as in the National Herbarium. A sheet taken by Dr. Mearns, in August, 1893, from near Monument no. 88 of the Mexican boundary line, on San José Mountain, presents some differences, and possibly may represent yet another species; as also many specimens collected in the Santa Rita Mountains by Mr. Pringle in 1881; though I tentatively refer all these to one.

✓ 25. **Ptelea attrita,** sp. nov.

Character of twigs, color and texture of foliage, etc., quite as in *P. betulifolia*, but leaflets all narrow and lanceolate, distinctly crenate rather than serrate, more or less pubescent on both faces; odd leaflet 5 to 7 cm. long, the laterals closely similar, a trifle smaller, scarcely inequilateral: samaras oval, many triquetrous; body oval, large and thick, of more than the width of the wing, not circumvallate, faintly and sparsely punctate, both its rugosity and the reticulation of the wing low and indistinct (as if worn down by friction); style and stipe both short, neither one prominent.

Camp Bowie, Arizona, J. T. Rothrock (in Wheeler's Exploration), 1874, distributed under number 499, at least as in the National Herbarium. Manifestly a near relative of *P. betulifolia;* possibly to be proven confluent with it. If so, certainty a marked variety.

26. **Ptelea similis,** sp. nov.

Twigs and branches chestnut-color, shining, white-dotted, pubescent the first season only, tortuous-angled rather than rugose: leaves subcoriaceous, very rich bright green above, the veins whitish-hirtellous, beneath very pale, with both a dense bloom and a short villous pubescence; odd leaflet cuneate-obovate to broadly and sharply rhomboid and rhombic-lanceolate, 4.5 to 7 cm. long, petiolulate, the pair often similar, smaller by but one-fourth or one-third, all entire or subserrulate: samaras broadly ovate, 2 cm. long, with base broad and subtruncate, apex abruptly acute and also mucronulate; body large, ovate, much broader than the wing, transverse-rugose, but the ridges broad and low, forming a circumvallation of the very edge of the body rather than beyond and around its base, gland-dots obscure; stipe very short, style thrice as long and prominent, the wing being broad all around the summit, and nearly obsolete at the very base.

Extreme eastern Arizona, 35 miles north of Clifton, at an altitude of 1,660 meters, in the canyon of Blue River, collected by Dr. Walter Hough, July 5, 1905, the specimen in the National Herbarium. Species intimately related to the two last preceding, if foliage is to be the more important index to affinity. Fruit of about the same size, but otherwise notably different from that of either; the only samara in the genus which, in so far as I have seen, may be described as ovate.

27. **Ptelea polyadenia,** sp. nov.

Twigs of the season invested with a velvety ferruginous tomentum concealing all unevenness, those of the second year glabrate, dull, dark brown, low-rugose: leaves subcoriaceous, 6 cm. long, the upper face light green and polished, but with also a sparse short pubescence, and closely dotted with dark glands; odd leaflet ovate-elliptic, more acute at base than at apex where it is bluntly short-pointed, laterals less than one-third smaller, obliquely oval, being rather notably inequilateral, all definitely, though lightly, crenate: samaras round-obovate, 1.5 cm. long, retuse or emarginate, thickish and hard as well as slightly concavo-convex in maturity; body round-oval, thick, of less than the average width of the wing, not circumvallate, distinctly and closely transverse-rugose and strongly dotted; style and stipe nearly equal, both short.

The type of this uncommonly well-marked species is on National Herbarium sheet no. 15267, purporting to have been obtained by Dr. Bigelow on Whipple's Expedition, on the Canadian River, somewhere between Fort Smith and the Rio Grande.

There are two other sheets from the same general region, collected more recently, that may or may not belong here—one by Dr. E. Palmer, from between Fort Cobb and Fort Arbuckle, in 1868, and one by M. A. Carleton, from Cheyenne County, Oklahoma, June, 1891. Both these are in early and immature state, though the fruits, if not mature, are nevertheless full grown and similar to those of the type, while, if the foliage is less remarkably gland-dotted, that may well be owing to their immaturity.

28. Ptelea aboriginum, sp. nov

Twigs of the season appearing more or less rugose, but the unevenness obscured by a short dense spreading pubescence, the older glabrate, smoothish, dark grayish-brown: leaves subcoriaceous, of a rather lively green above, pale beneath, both faces with obscure and scattered hints of pubescence and conspicuously punctate; odd leaflet obovate-elliptic to rhomboid-elliptic or rhomboid-lanceolate, about 5 to 7 cm. long, acute at apex, crenate or subentire, the pair quite similar, but smaller by one-third or one-half, seldom obviously inequilateral: samara 1.5 to 2 cm. long, almost as broad, little deviating from the orbicular, truncate or emarginate at base, at apex usually obtuse, sometimes retuse; body thick, round-oval, large, its width notably exceeding that of the wing, lightly circumvallate, the transverse rugosity low, somewhat reticulately broken, the gland dots large and obvious; stipe broad, cuneate-linear, a little longer than the slender style.

Rocky hills, Signal Mountain, Indian Territory, August 4, 1891, C. S. Sheldon, no. 247, as in the National Herbarium.

29. Ptelea lucida, sp. nov.

Twigs dark red-brown, low-rugose, obscurely if at all glandular, glabrous or with scattered small hairs: leaves not large, subcoriaceous, glabrous except a few scattered hairs along the margin and the midvein beneath, bright green and shining above, lighter and without luster beneath, in no part pale or glaucescent; odd leaflet cuneate-obovate, very obtuse, 4 to 5 cm. long, 2 to 2.5 cm. wide above the middle, all obscurely crenulate, though seeming quite entire, a very narrow margin being revolute, the pair like the odd one in outline though smaller and inequilateral: samaras large for the foliage, suborbicular, 2 cm. wide, the length somewhat less, both ends being retuse, the body round-oval, of less than the width of the wing, lightly circumvallate, the rugosity obscure and inclined to be radiate.

Rocky bluffs of Comanche Peak, Texas, J. Reverchon, June, 1882, no. 1229, as in the herbarium of John Donnell Smith.

In the National Herbarium, occupying sheet no. 125, are two immature twigs from Gillespie County, Texas, collected by G. Jermy, that seem to be *P. lucida*. A third, on sheet 358374 from Kerr County, in the same State, by W. L. Bray, is obviously to be referred here, although fruit in this is only half grown. The leaves in these early specimens are of course thin, not subcoriaceous as in the mature type specimen collected by Reverchon.

30. Ptelea toxicodendron Small, Bull. Torr. Club **28** : 294. 1901.

Mature twigs dull rather dark brown, glabrous, remarkably smooth; foliage of a vivid almost shining green above, less vivid but not pale beneath, in age doubtless subcoriaceous; odd leaflet obovate, 4.5 to 6 cm. long, abruptly acute at base, at apex obtuse or even emarginate, plainly crenate, the larger doubly so, the pair commonly smaller by one-half or one-third, nearly ovate and but slightly inequilateral, all sessile: samaras unknown.

Kerrville, Texas, May 3, 1894, A. A. Heller, in flower and perhaps nearly full-grown foliage; distributed under no. 1690. In the mere outline of them the leaflets recall those of *P. betulifolia* of Arizona, but the two are otherwise very unlike.

31. **Ptelea persicifolia,** sp. nov

Twigs of the season light chestnut-color but dull and puberulent, finely rugulose: foliage of a light green, almost subcoriaceous, lighter beneath, and with scanty pubescence of rather long hairs; odd leaflet somewhat broadly and elliptically lanceolate, 5 to 7 cm. long, abruptly acuminate, the pair similar and not much smaller, all sessile, subentire: samaras nearly orbicular, obtuse at both ends, 2 cm. broad, not quite as long; body round-oval, of less than the width of the wing, sinuously circumvallate, definitely transverse-rugose and strongly dotted; style twice as long as the stipe.

Huntsville, Oklahoma, June 5, 1896, Laura A. Blankinship. Species in several respects peculiar, not easy to place. Type in the National Herbarium.

32. **Ptelea subvestita,** sp. nov.

Mature twigs of the season quite velvety, the indument concealing the evidently lightly rugose and red-brown bark, the petioles also softly villous, and the lower face of the leaves, these subcoriaceous, glaucescent even above, and with mere traces of a scattered pubescence beyond the veins and veinlets, the latter more distinctly pubescent; odd leaflet rhombic-lanceolate to elliptic-lanceolate, acute at both ends, 4 to 6 cm. long, lightly and often obscurely crenate, the pair inequilateral and obliquely oval, smaller by about one-third; samaras suborbicular, 2 cm. long, more or less; body oval, about as wide as the wing, indistinctly circumvallate, coarsely low-rugose, the ridges not definitely transverse, scantily and obscurely punctate; style and stipe both prominent, subequal.

Dry hills about Silver City and Fort Bayard, southern New Mexico, the type specimens collected by myself in mature fruit, July 20, 1880, and preserved in the Herbarium of the California Academy. Late in November of 1905 the same was collected at Fort Bayard by Mr. J. C. Blumer, the twigs laden with mature fruit of the largest dimensions, the foliage having mostly fallen at that date; but the identity of these specimens with mine, as to the species, is certain, both from the twigs and from such foliage as was preserved.

33. **Ptelea padifolia,** sp. nov.

Growing twigs delicately but densely puberulent under a not sparse indument of hirsute hairs which is deciduous, those of the second season wholly divested of the hirsute hairs, only puberulent, even obscurely so, the red-brown bark appearing glabrous, scarcely at all rugulose or glandular: leaves of a vivid green above, nearly glabrous, some short hirtellous hairs along the midvein, and a few more short and appressed scattered over the surface, the lower face pale and almost hoary with a minute villous tomentum; odd leaflet from narrowly crenate-obovate to almost rhomboid-lanceolate, 5 to 7 cm. long, cuspidately acute, the pair smaller by from one-fourth to one-third, mostly oblique-oval and pointless, all neatly and evenly crenulate: samaras not quite mature but full-grown round-oval, nearly 2 cm. long, 1.8 cm. wide; body broad-oval, not as wide as the wing; style and stipe equal.

Western Texas, in the canyon of the Rio Limpia, April 26, 1902, S. M. Tracy and F. S. Earle, no. 272, as in my herbarium (type) and the National Herbarium.

Most unlike all other species of Texas regions westward in its thin deep-green foliage; this by its slender whitish veins, evenly crenulate margins, and even by the outline of the terminal leaflets, readily recalls that of some of the so-called wild cherries.

34. Ptelea neo-mexicana, sp. nov.

Shrub 2 to 3 meters high; twigs of the season olive-green, glandular-tuberculate, scarcely rugulose, minutely and sparsely villous-hirtellous, the petioles, pedicels, and lower face of leaves more pronouncedly so: foliage thin, of a very bright and lively green above with a trace of pubescence on the veins, beneath pale though hardly glaucescent, but with scattered soft hairs; odd leaflet lance-rhomboid, 5.5 to 7.5 cm. long, equally acute at each end, the laterals sometimes as large, oftener smaller by one-fourth, obliquely ovate, very inequilateral, acute, all evenly and obviously crenate, not notably punctate on either face: samaras large, thin, and flat, suborbicular, 2 cm. wide, the length less by 1 mm. or more, both ends a little retuse; body round-oval or almost orbicular, of about the width of the wing, circumvallate, the rugosity pronounced and elevated, more or less broken into transversely elongated reticulations, the gland-dots obscure; style and stipe not very unequal, the latter a trifle shorter.

In the Black Range, southern New Mexico, at about 2,270 meters, O. B. Metcalfe, October 11, 1904, his no. 1479, as in the National Herbarium. Fendler's no. 95 may perhaps be the same, but the fruit in his specimens is only half grown, yet the foliage, so much younger than in Metcalfe's, is nevertheless of a firmer texture, which is prejudicial against its being the same.

35. Ptelea acutifolia Greene & Rose, sp. nov.

Twigs of the season dull chestnut-color, rather sharply and angulately rugose and puberulent, the older glabrate, darker, obtusely and tortuously striate: leaves firm but not subcoriaceous, deep green above, paler beneath and villous-strigulose, definitely crenulate, all on elongated petioles mostly 6 to 8 cm. long; odd leaflet lance-elliptic, very acute at both ends, 5.5 to 8 cm. long, the pair usually but little smaller and of the same outline, being scarcely inequilateral: samaras small for the foliage, transversely subquadrate-orbicular to quite orbicular, the largest and most quadrate 2 cm. wide, 1.5 cm. long, such subtruncate at both ends; body very round-ovoid, hardly as broad as the wing, lightly circumvallate, not at all sharply transverse-rugose, moderately punctate; style and stipe nearly equal.

State of Jalisco, Mexico, on the road between Huejuquilla and Mesquitec, August 25, 1897, Dr. J. N. Rose, no. 2580, as in the National Herbarium. Species not otherwise known, and remarkable for the great length of the petioles, the leaflets not acuminate, though very acute.

36. Ptelea megacarpa Rose, sp. nov.

Twigs tortuously striate rather than rugulose, and with glands between the lines; bark chestnut-colored when mature, glabrous: leaves large, of thin texture, vivid dark-green on both faces, scarcely lighter beneath and not in the least glaucescent, glabrous; leaflets ovate-elliptic, the pair almost or quite as large as the odd one, oblique rather than notably inequilateral, all cuspidately acuminate, entire, the odd one 7 to 12 cm. long: samaras very large, thin and flat, the circumscription exactly orbicular, abruptly subcordate at base and equally obcordate-notched at apex, both the length and breadth about 3.5 cm.; body small in proportion to the wing, circumvallate, transverse-rugose, almost dotless, as also the wing; style of thrice the length of the stipe.

Dr. Rose establishes this handsome species on Mr. Pringle's no. 8868 (type in the National Herbarium), from the State of Hidalgo, Mexico; and it has been so distributed.

Mr. Pringle reports it to attain the dimensions of a small tree at about 1,600 meters altitude below Trinidad Iron Works, where it was obtained by him June 2, 1904. Flowers were collected May 10, but, unhappily, none but the pistillate; so that the character of the filaments can not be given.

37. Ptelea laetissima Greene & Rose, sp. nov.

Twigs of the season dull red-brown, lightly rugulose, puberulent, the older dull brown, glabrate, smoothish: leaves small, of a light very bright green above, light dull green beneath, with faint trace of minute scattered hairiness on both faces, but to the unaided eye glabrous; odd leaflet lanceolate, acutish at both ends, about 5 cm. long, the pair similar and hardly inequilateral, only about half as large, all sessile, obsoletely crenulate: samaras large for the foliage, greenish in maturity, orbicular, about 1.8 cm. long and broad, truncate at base, emarginate at apex; body oval, of less than the width of the wing, prominently rugose, but the wrinkles not very continuously transverse, punctuation not strong; stile and stipe nearly equal, both slender yet prominent.

Near Tehuacan, State of Puebla, Mexico, September, 1905, collected by Messrs. Rose, Painter, and Rose (no. 9927), type in the National Herbarium. The specimens being at that date in fruit nearly matured, and with foliage bright and untarnished as if that of early summer at the North, are evidence that the species comes into leaf and flower only late in summer after the beginning of the rainy season.

We have in the United States no Ptelea to equal this in the beauty of its light green almost brilliant foliage, a strong tinge of which is held by even the mature fruit.

38. Ptelea verrucosa, sp. nov.

Twigs of the season greenish at maturity, verrucose-roughened with crowded short rugosities each crowned with a conspicuous gland, the intervening small furrows with a few hairs, the older twigs smoother, straw-colored, glabrate but still low-tuberculate: foliage vivid green above, paler beneath, stiffly subcoriaceous, strongly punctate on both faces and with evident traces of pubescence; odd leaflet ovate above an abruptly cuneate base, 4 to 6 cm. long, cuspidately pointed but the very apex emarginate, the whole margin very lightly though not finely crenate: samara small for the foliage, exactly orbicular, 1.3 to 1.5 cm. long, quite as broad; body round-obovate, broader than the wing, lightly circumvallate, coarsely reticulate and pitted, the glands many and evident; style prominent, more than twice as long as the very short stipe.

Well marked species known in but a single but very satisfactory specimen in the collection of the old Mexican Boundary Survey, mounted on National Herbarium sheet no. 624, along with fragments of three other species. No special locality is indicated for any of the specimens.

39. Ptelea ambigens, sp. nov.

Shrub, probably low, all the twigs and branches short, stoutish, flexuous, very leafy, scarcely tuberculate and but lightly rugose in any stage, in all pale straw-color, glabrous: leaves quite firmly subcoriaceous, glabrous pale and glaucescent beneath, only very obscurely punctate; middle leaflet obovate, 4 to 5 cm. long, abruptly cuneate at base, acute at apex, the pair obliquely oval, smaller by one-half or one-third, all more or less distinctly crenate: samaras suborbicular, mostly a trifle broader than long, the width in the larger 2 cm. the length 1.8 cm., some smaller even a trifle longer than broad and inclining to obovate; body oval, of less than the width of the wing, with but faint traces of transverse ridges, no circumvallation, but copiously dotted: style shorter than the stipe.

The only specimen, but that a very good one, is from some unmentioned station in southern Utah, and was collected by Dr. E. Palmer as long ago as 1877. The species is peculiar as exhibiting along with the whitish and shining twigs of this group a foliage not so distinctly yellow-green, the lower face being quite glaucescent, as in none of its near allies.

√ 40. **Ptelea nitens,** sp. nov.

Shrub low, compact, densely leafy and floriferous; twigs of the season light yellowish brown, roughened by short ridges each bearing a low tubercular gland, delicately puberulent or glabrous, the older only very light brown, smooth, glabrate, almost shining: leaves subcoriaceous, light green, coarsely gland-dotted and glabrous above, paler beneath and less glandular, obscurely pubescent along the midvein; odd leaflet 4 to 5 cm. long, rhombic-lanceolate, very acute or shortly acuminate, faintly crenate, the pair slightly inequilateral, nearly as large: samaras suborbicular inclining to ovoid, 1.5 to 1.8 cm. long, subcordate, the apex obtuse or retuse, the whole of firm hard texture and somewhat polished, body oval and very long in proportion, circumvallate, strongly wrinkled but irregularly rather than transversely, the glands few and not prominent; style greatly elongated, stipe very short, almost obsolete.

Canyon of the Arkansas River above Canon City, Colorado, July, 1892, Miss Eastwood, the type in the Herbarium of the California Academy, in copious fruit. The species was collected by myself in the same canyon in 1896, but in leaf only, no fruit seen. A specimen in young fruit, taken in June, 1892, by Mr. J. H. Cowen at Florence, well down the Arkansas Valley toward the plains, may also belong here; but the bark in this is straw-colored and the immature foliage abruptly rather long-acuminate.

41. **Ptelea pallida,** sp. nov.

Twigs of the season of a light yellowish-brown, puberulent, elongated-rugose, hardly glandular, those of a former season glabrate, light ash-gray, low-rugose: leaves not large, rigidly subcoriaceous, dull pale green above, beneath still paler and glaucescent, both faces glabrous except as to mere traces of short pubescence on the veins and margin; odd leaflet elliptic-lanceolate, 3.5 to 5.5 cm. long, lateral pair one-half to three-fourths as large, obliquely oblong-lanceolate, all minutely crenate-subserrulate, the petioles 3.5 to 4.5 cm. long and remarkably slender: samaras large for the foliage, 1.5 to 2 cm. long, almost exactly orbicular, very obtuse or almost truncate at each end; body oval, of less than the width of the wing, not distinctly circumvallate, the ridges low, seldom definitely transverse, usually of a sinuous irregularity and with few large gland-dots interspersed; wing smoothish, the reticulation low; style long, stipe half as long, both prominent.

Arid rocky hills above Peach Springs, northern Arizona, collected by the writer July 3, 1889; type in the National Herbarium. The species is peculiar, not easily associated with any group.

42. **Ptelea straminea,** sp. nov.

Fruiting twigs short, stout, almost divaricate or a little recurved, straw-colored and deeply so, almost yellowish, delicately puberulent, faintly rugulose, almost glandless, the dots few, low, obscure, the bark of older twigs whitish, glabrate, smooth and polished: leaves not thick, hardly suboriaceous, of almost the same bright light green on both faces, everywhere glabrous, only faintly and sparsely punctate; odd leaflet obovate, 4 to 6.5 cm. long, acute at base, obtuse at apex, definitely and not finely crenate, the laterals often quite similar scarcely smaller, sometimes smaller by one-third and acute but seldom at all inequilateral: samaras large, of suborbicular outline but broader than long, the width fully 2 cm., strongly both cordate and obcordate, the whole being thus somewhat 2-lobed; body orbicular and central, of much less than the width of the wing, only faintly low-rugose, very notably and densely glandular.

Rocky slopes of the Virgin Mountains in extreme northwestern Arizona, C. A. Purpus, 1898; his no. 6165 as in the National Herbarium. In the foliage and fruit there are suggestions of affinity between this and the Californian members of the genus; nevertheless the whitish and shining twigs attest its being really of the present singular group of northern Arizona, though differing considerably from most others as to its broad obovate leaflets of rather thinnish texture.

43. Ptelea nitida, sp. nov.

Shrub perhaps low, the branching at least compact, the fructification copious, in short and very few-flowered panicles; all twigs and branches whitish, very smooth and somewhat shining: leaves small, of the same light green on both faces, glabrous, strongly punctate; middle leaflet ovate-lanceolate, 3 to 4 cm. long, acutish at each end, obscurely crenulate, the laterals oval to lanceolate and from nearly or quite as large to smaller by about one-third, all sessile: samaras large for the leaves, all triquetrous, the faces round-obcordate, 1.5 cm. in length and breadth, retuse at base but obcordate at the broad summit; body oval, of less than the width of the wing, very faintly circumvallate, but also the rugosity equally low and obscure, as is also the reticulation of the wing, the fruit as a whole remarkably smooth and polished, the scattered punctuation hardly more obvious.

Species known to me only as in the Herbarium of the California Academy from somewhere in the Grand Canyon of the Colorado in Arizona, collected by E. O. Wooton, July 8, 1892.

44. Ptelea argentea, sp. nov.

Twigs whitish and polished, much smoother than in any others of the group, neither ridges nor glands obvious to the unaided eye: leaves hard and quite coriaceous, of a bright but not shining green above, very pale and with a silvery gloss beneath, yet everywhere perfectly glabrous; odd leaflet lanceolate or even slightly rhombic-lanceolate, acute, 3 to 4.5 cm. long, laterals smaller by about one-fourth, lanceolate, all sessile, obscurely subserrulate: samaras large for the foliage, usually triquetrous, those 2-winged and plane-suborbicular but broader than long, the breadth 1.5 cm.; body in all elongated-obovate, marked throughout its length with obscure low but quite transverse ridges and with low circumvallation, the dots many, yet inconspicuous; style slender, not long, yet longer than the short cuneiform stipe.

This species, remarkable for its leathery foliage, silvery-lustrous beneath, is known to me only as collected by Dr. F. H. Knowlton, somewhere in the Grand Canyon of the Colorado, September 10, 1889, the specimens filling two sheets in the National Herbarium (one the type). Notwithstanding the luster on the lower face of the leaflets, I am unable to detect any indument there, either lepidote or otherwise.

45. Ptelea neglecta, sp. nov.

Mature twigs of the season light chestnut-color, short-rugulose, glandular-tuberculate, glabrous, those a year old whitish, smoother and shining. leaves equally light-green on both faces, subcoriaceous, glabrous, conspicuously and darkly gland-dotted, odd leaflet lanceolate, 3.5 to 5 cm. long, obtuse, the pair commonly little smaller, equal-sided, all obscurely or not at all crenate, sessile: samara very large for the foliage, 2 to 2.2 cm. long, broadly oval or obovate, retuse at both ends, body rather narrowly oval and long, of the width of the wing, not rugose but very strongly gland-dotted, the dots, however, in some disposed in rather definitely transverse lines, style and stipe subequal, both short.

Near Kanab, southern Utah, A. Wetherill, 1897; the only specimens in the Herbarium of the California Academy, consisting of two sorry fragments, but well in fruit, and evincing a marked species.

46. Ptelea triptera, sp. nov.

Shrub apparently low, the whitish or straw-colored branches more glandular-tuberculate than rugose: leaves small, in maturity subcoriaceous, yellow-green and glabrous throughout; leaflets all lanceolate, sessile, slightly acuminate, the odd one 3 to 4.5 cm. long, the laterals notably smaller, all obscurely subserrate or dentate: samaras large for the foliage, almost invariably triquetrous, the face broadly round-cordate, the apex being narrower, yet rather broad and emarginate; body round-oval, not transverse-rugose but deeply pitted-reticulate, a conspicuous gland in each pit, the whole body slightly circumvallate, of less than the width of the wing, the fruit as a whole 1.5 cm. long and quite as broad near the base.

Grand Canyon of the Colorado, Arizona, excellent specimen in the National Herbarium, collected by J. W. Toumey, July 11, 1892.

47. Ptelea lutescens, sp. nov.

Bark of all twigs and branches whitish and shining as well as strongly rugulose and faintly and sparingly glandular-tuberculate: foliage light green, a little pale beneath, of barely subcoriaceous texture, densely and minutely dotted on both faces; odd leaflet lanceolate above a rather long cuneate base, 4 to 6 cm. long, laterals from nearly as large to smaller by one-half, obliquely lanceolate, all lightly subserrate-toothed and quite sessile: samaras large, suborbicular, 2 cm. wide and not quite as long, subtruncate across the broad summit, the base often slightly retuse; body oval, of little more than half the width of the wing, faintly transverse-rugose and circumvallate, not strongly gland-dotted; style and stipe about equal.

Species of northwestern Arizona, inhabiting canyons tributary to the Grand Canyon of the Colorado, the best specimen from Red Canyon Trail, collected June 10, 1901, by Lester F. Ward (type in the National Herbarium). Younger material, with fruit not mature, from Bright Angel Trail, by Dr. C. Hart Merriam, May 10, 1903. These last imperfect specimens have smaller relatively broader leaflets, and may possibly represent another species.

48. Ptelea elegans, sp. nov.

Twigs much smoother than in the last, and straw-colored rather than whitish, the rugosity less prominent: leaves thinner, twice as large, the middle leaflet lanceolate, acuminate, all these sessile, obscurely subserrate-toothed: samaras fully 2 cm. wide and of the same length except as notched broadly and deeply at both ends between rounded cordate lobes; body obovoid, distinctly yet delicately transverse-rugose not circumvallate, small dotted; style short, stipe none.

Grand Canyon of the Colorado, Arizona, June 14, 1891, D. T. McDougal, the shrub said to grow "in rich soil and in water." The only specimens seen are in the National Herbarium.

49. Ptelea confinis, sp. nov.

Immature twigs of the season, short, crooked, whitish, rugulose and polished, but also sparingly pubescent; those a year or two old dull brownish, glabrate, less rugulose, notably glandular-tuberculate: leaves small, of a light somewhat yellowish green above, paler and glaucescent beneath; odd leaflet 3 to 4 cm. long, rhombic-lanceolate or merely ovate-lanceolate, the laterals almost as large, obliquely lanceolate, all acutish, sessile, finely and evenly or very obscurely serrulate: samaras large for the foliage, suborbicular, 1.5 cm. long and of the same breadth, retuse at base, minutely cuspidate-acute at apex; body oval, of less than the width of the wing, conspicuously transverse-rugose and dotted; style and stipe both short.

El Paso, Texas, April, 1881, G. R. Vasey; specimens with fruit unripe, but apparently almost or quite full grown.

The plant is interesting as belonging to that group of white-barked species inhabiting the region of the Grand Canyon of the Colorado in northwestern Arizona and adjacent Utah.

The material examined is on four sheets in the National Herbarium, among which I would name that on sheet 15254 as the type.

50. Ptelea saligna, sp. nov.

Twigs and branches all with whitish shining bark faintly rugose, not obviously glandular, glabrous: foliage thinnish, clear light green above, paler beneath, pustulate-punctate but glands colorless and obscure, both faces glabrous; odd leaflet narrowly lanceolate or even lance-linear, slightly acuminate but the very apex obtuse, 5 to 9 cm. long including a distinct and not very short petiolule, the pair one-third smaller, short-petiolulate, in general narrower in proportion but equal-sided, all lightly crenate: samaras large, subreniform-orbicular, being always broader than long, the breadth 1.5 to 2 cm., base subcordate, apex not so, but now and then mucronate-acutish; body oval, smallish, of little more than half the width of the wing, very lightly transverse-rugose and faintly dotted, not circumvallate, the faint ridges becoming more prominent as graduating into the somewhat retrorse venation of the wing; style and stipe equal, or the former longer.

Nagle's Ranch, Arizona, altitude 2,240 meters, M. E. Jones, September 15, 1894, no. 6048, as in the National Herbarium (type) and the Herbarium of the California Academy. Most peculiar species, having long narrow leaflets imitating the leaves of *Salix nigra* in color, form, and texture. The locality is in northern Arizona, north of the Grand Canyon.

51. Ptelea brevistylis, sp. nov.

Twigs and branches for two seasons dark reddish brown, sparsely puberulent, not rugulose, but roughened with a rather close tuberculation: leaflets of a dull light green, ovate- to oblong- lanceolate, 5 cm. long, in age glabrate, doubtless pubescent when young, the margins lightly crenulate: samaras large and with broad thinnish wing, the outline usually round-obovate, but in some nearly orbicular, the length of the largest 2 cm., the breadth toward the summit 1.8 cm.; body of the fruit large, round-obovate, very obscurely and irregularly rugose, somewhat pubescent, strongly gland-dotted, very eccentric, its summit nearly or quite styleless and the wing thin, deeply emarginate, or obcordate, the almost sessile stigma in the notch, the base of the wing merely subcordate and the stipe long.

Of this shrub, singular among Californian species of Ptelea by its large fruit with broad wing, which is subcordate at base and nearly obcordate at summit, only a single specimen has been seen, and that imperfect as to foliage, but with a fine cluster of fruits. It was collected by G. R. Vasey in 1875, in what part of the State it is impossible to ascertain.

It is unmistakably Californian by the peculiar hue and venation of foliage that are common to all known Californian species, and which occur in no others; and its fruit is pubescent, as in none but Californian members of the genus. The type specimen is in the National Herbarium, sheet no. 321.

52. Ptelea ovalifolia, sp. nov.

Mature twigs of the season chestnut-color, lightly rugulose, quite as prominently tuberculate, minutely and not densely puberulent, those a year old glabrate, the tuberculation more prominent, the rugosity less so: leaves ample, firm, but not subcoriaceous, of a light vivid green on both faces and almost polished, a trifle paler and duller beneath, with mere traces of pubescence on veins and veinlets; terminal leaflet oval, 6.5 to 8 cm. long, 3.5 to 4 cm. broad, the pair smaller by one-fourth to one-third, obliquely oval, all sessile, nearly obtuse, some with a short and abrupt blunt point, all more or less crenate: samaras small for the foliage, subreniform-orbicular, the width being about 1.7 cm., the length only 1.4 cm., the base retuse, the apex only very obtuse; body broadly round-oval, large, its width notably greater than that of the wing, obscurely puberulent in full maturity, the rugosities tending transversely but almost wholly broken into pitted reticulations, each with a gland at bottom; style and stipe not obscure, both short.

The type, and only known specimen, I find on sheet 321, National Herbarium, collected in California in 1875 by G. R. Vasey, no other data given; in all the valuable collection of Californian Ptelea belonging to the California Academy there is nothing showing approach to this in respect to either its broad and large oval leaflets or its transversely elongated samaras.

53. Ptelea cinnamomea, sp. nov.

Twigs of the season of a rather bright cinnamon-red, glabrous, rugose and glandular-tuberculate but polished, those a year old similar but darker and not shining: leaves thin, of a vivid light-green above, paler beneath, copiously glandular and the glands colorless and pellucid, obscurely puberulent along the veins beneath, glabrous and shining above; middle leaflet 5 to 7.5 cm. long, obovate-oblong and obtuse as to those of the lower and fruiting branches, elliptic-lanceolate on vigorous sterile shoots, always obtuse, lightly crenate, the pair two-thirds as large, only slightly inequilateral: samara from suborbicular to somewhat obovate, about 18 mm. long, obtuse at base, at apex subulate-pointed, by the projecting style pervading a cusp-like continuation of the wing, the body very large, much wider than the width of the wing, suborbicular to round-obovate, the usual transverse ridges faint, apt to be broken into something like a reticulation, the intervals strongly glandular.

Vicinity of Ione, California, in the foothills of the Sierra, June, 1904, Ernest Braunton; type in the National Herbarium.

54. Ptelea crenulata Greene, Pittonia 1: 216. 1888.

Ptelea angustifolia Brew. & Wats. Bot. Cal. **1**: 97. 1876, in part, not Benth.

Ptelea crenulata Greene, Pittonia **1**: 216. 1888; Flora Franciscana 75. 1891; Man. Bay-Reg. 72. 1894, of all in part only.

Young twigs gland-dotted and sparsely hirtellous-villous, those of the second season dark brown or blackish, glabrate, glandular-tuberculate and rugulose: leaflets notably unequal, the laterals one-third to two-thirds the size of the terminal, this 4 to 7 cm. long, broadly to narrowly cuneate-obovate, all of rather light vivid green, gland-dotted and more or less puberulent, the feather veins strongly divergent and on the lower face whitish and very conspicuous, the margins crenulate, or in the largest and most vigorous specimens doubly subserrate crenulate, the apex acute or in some obtusish: branches of the inflorescence and the pedicels minutely hirtellous: filaments hirsutulous from base to above the middle: samara orbicular, 1.4 to 1.6 cm. wide, the length from slightly less to a trifle more, not flat but distinctly concavo-convex, sometimes a little retuse at both ends, sometimes at neither; body very large and thick, of nearly or quite twice the width of the wing, very broadly round-oval or almost orbicular, not circumvallate, closely but irregularly transverse-rugose and also marked, at least from the middle upward, by a broad, shallow furrow, the whole moderately gland-dotted and puberulent; style and stipe short, equal.

The description of this more common Californian species is here completed in the light of perfect material from Mount Diablo, partly as collected by the late Dr. Parry, July 4, 1872, and partly from a pocket of many mature samaras brought from the same locality, October, 1898, by Dr. C. Hart Merriam. Its habitat on that mountain seems to be in Mitchell's Canyon, on the northward slope, and, as Dr. Merriam informs me, at an elevation of about 300 meters. Flowering specimens were distributed from this station by C. F. Baker, collected by himself in April, 1903, the distribution numbers being 2942 and 2943. The species appears to occur at various other places up and down the Coast Range of middle California.

Number 5564 of Heller & Brown, from the Marysville Buttes, distributed for *P. crenulata*, I suspect may represent another and a more local species; but the specimens are, as usual, in flower only. A like degree of uncertainty exists in relation to a sheet from Kaweah, Tulare County, collected by Miss Eastwood, April, 1895.

55. Ptelea bullata, sp. nov.

Shrub dioecious, the male not known: growing twigs obscurely puberulent, rugulose; older branches dark-brown, glabrous: leaves of a light and vivid green, lighter beneath, glabrous on both faces except for a sparse short pubescence on the midvein beneath, sparsely gland-dotted and very minutely densely puncticulate; terminal leaflet elliptic-lanceolate, 5 to 6.5 cm. long, acute at both ends, not very distinctly subserrulate, the pair more than two-thirds as large, more or less inequilateral; flowers many, in ample loose subcorymbose panicles, but these sessile, not equaling the foliage: samaras suborbicular or inclining to round-obovate, abruptly acute, the base truncate or subcordate, about 1.5 cm. long, 1.2 cm. wide above the middle; body large, round-ovate, much wider than the width of the wing, puberulent, faintly circumvallate, gland-dotted only while immature, in maturity finely transverse-rugose, but the intervals between the ridges elevated above them and as if inflated.

Anderson's Ranch, Lower Lake, Lake County, California, May 11, 1901, Agnes Bowman; type specimen in the Herbarium of the California Academy; no others seen. The species is a most notable one in the characters of its fruit, this being destitute of dot-like glands, and the surface of the capsular body rising in blister-like elevations between the uncommonly slender and low transverse ridges, all manifestly quite normal.

56. Ptelea cycloloma, sp. nov.

Young twigs and other growing parts puberulent, even older twigs and branches puberulent, dark-brown, tuberculate, but mature foliage more obscurely pubescent or puberulent, yet not glabrous on either face, wholly of a light but dull green; terminal leaflet oblong, lanceolate, obtuse, but at base abruptly acutish, 4.5 to 6 cm. long, somewhat crenulate, the pair about two-thirds as large, only slightly inequilateral: samaras variable as to size, the smaller 1 cm., the larger 1.5 cm., wide, orbicular, not notched or lobed or truncated at either end; body unusually large, commonly almost obicular, its breadth nearly twice that of the wing, also unusually thick and double convex, with no trace of circumvallation, only a low transverse rugosity but with copious and prominent gland-dots.

Mountains near Mariposa in the Sierra Nevada, California, collected by J. W. Congdon, the fruiting specimens in July, 1893, the flowering in May, 1894; type in the Herbarium of the California Academy, sheet no. 12214. The flowering specimens are from the pistillate shrub, and the stamens therefore unknown. The species is most interesting, inasmuch as its fruits, with their unusually large and thick nut-like body and narrow wing, make some approach, not however any near approach, to those of the more southerly *P. aptera.*

57. Ptelea nucifera, sp. nov.

Ptelea aptera Brandegee, Proc. Cal. Acad. II. **2**: 138. 1889, not Parry.

Evidently a low stunted shrub, the branches of the season and leaf-bearing twigs mostly less than an inch long, dark brown, puberulent, not strongly tuberculate; flowers and early foliage not known: mature leaves subcoriaceous, small, the leaflets very unequal, the lateral pair usually greatly reduced and unequally so, the odd leaflet narrowly obovate-oblong to obovate, lightly and not closely crenate, the whole leaf glabrous and coarsely gland-dotted above, scantily pubescent beneath: fruits oval, 2 cm. long, very thick and nut-like, encircled by a distinct though narrow wing, this and the body thickly beset with low tubercles frustulate at summit.

Las Huevitas, Lower California, May 20, 1889, T. S. Brandegee. Type in the Herbarium of the California Academy. It is mounted on the same sheet with some of Dr. Parry's specimens of his *P. aptera,* and even the fruits of *P. nucifera,* all detached from the twigs that supported them, have been recklessly placed within the same pocket containing those of *P. aptera;* but they are so different as to be segregated without the least difficulty. They are fully three times—now and then four times—the size of those of *P. aptera*, but have a wing. The body has its own outline, being exactly oval in *P. nucifera*, whereas in *P. aptera* it is, as Dr. Parry said, "broadly ovate."

The locality of *P. nucifera* is well down toward the middle of the Lower Californian Peninsula, and at some distance inland, in the vicinity of a desert water hole, while *P. aptera* is maritime, inhabiting hills that slope down to the sea, well toward the northern extremity of the peninsula.

Specimens of the fruit of *P. nucifera* appear to have been communicated by Mr. Brandegee to Dr. Parry; for in the Parry Herbarium I find attached to the type sheet two pockets, one containing his types of the fruit of *P. aptera* and so labeled; the other inclosing five perfect samaras of *P. nucifera*. This pocket is without a mark of any kind in Dr. Parry's hand; as if he may have entertained some doubt about its contents being referable to *P. aptera*.

58. **Ptelea obscura** sp. nov.

Shrub slender, probably low, the slender twigs after the first season dark-brown, glabrate, closely regulose and strongly glandular, all the growing parts, including both faces of the leaves, minutely and sparsely appressed-pubescent; odd leaflet about 3 cm. long, narrowly rhomboid-ovate, broadest in the middle or below it, acute at base, acutish at apex, lateral leaflets from less to more than half as large, inequilaterally oblong-ovate, the leaf as a whole of a light-green, the lower face lighter but not glaucescent; flower large, solitary, the petals oblong-obovate, short-unguiculate, densely puberulent without and within; filaments long, but stoutly subulate, glabrous throughout: fruit not known with certainty.

Near Santo Tomas, lower California, May 17, 1886, C. R. Orcutt; type in the United States National Herbarium. The locality of this is not, like that of *P. aptera*, maritime, but well inland among the peninsular hills and mountains, a fact which of itself would betoken specific difference, especially on our Pacific coast anywhere, and on the peninsula of lower California it would be little short of decisive. But there are excellent characters of foliage upon which to establish *P. obscura* as a species; and there is ground for a suspicion that its fruit furnished the type of the figure of so-called *P. aptera* in the third volume of Garden and Forest, as I have suggested below under that species.

59. **Ptelea aptera** Parry, Proc. Davenp. Acad. **4**: 39. 1884.

Ptelea aptera Sargent, Gard. & Forest **3**: 333. *fig. 45*. 1890, in part.

Shrub much branched and rigid, about 2 to 5 meters high, all the growing parts appressed-pubescent, but twigs and branches after the first season dark-brown and glabrate, rugulose and glandular-tuberculate: mature foliage unknown, the leaves at early flowering small, with leaflets not very unequal, the odd one 1.5 to 2 cm. long, narrowly obovate, obtuse, crenulate, the crenatures commonly obscured by the revolute character of the whole margin: flowers solitary, or very few and corymbose, usually pentamerous, large, the filaments glabrous: fruit wingless and nut-like, round-ovate or subcordate-ovate, emarginate at apex, mostly less, rarely more than 1 cm. long, somewhat sinuately rugulose, and conspicuously dotted with coarse tubercles, depressed or flattened at summit as if pustulate when growing.

The above diagnosis is drawn wholly from Dr. Parry's original specimens as collected by himself and Mr. Orcutt from slopes of hills along the seashore at Punta Banda, northern lower California, January 24, 1883. These type specimens were made available through the courtesy of Dr. Pammel, of the Iowa Agricultural College at Ames, Iowa, where Dr. Parry's herbarium is now in keeping. I recall that Dr. Parry, immediately after his return to San Francisco from that expedition to the peninsula, reported to me the interesting discovery of a wingless-fruited Ptelea, showing me specimens and remarking that the shrub was, at the time of collecting, in young leaf and early flower, but that on some branches, or else upon the ground beneath the bushes, Mr. Orcutt had first detected a few fruits, of which they succeeded, through diligent search, in obtaining a small quantity for distribution.

In addition to this sheet of type specimens I have one duplicate sheet before me, and that an excellent one, that he presented to the California Academy at the time. Another, less ample, was at the same time sent to the Herbarium of the Department of Agriculture (now in the National Herbarium) at Washington; but with this there are five good fruits. A sheet in the herbarium of Capt. John Donnell Smith, of Baltimore, in respect to the size of the branches and copiousness of flowers, the best of all, is also a part of the original collection as made by Mr. Orcutt.

The volume of Davenport Academy Proceedings, in which the species was published, was issued in 1884. Since that date there have been at least two other collections of Ptelea made on the peninsula, one by Mr. Orcutt at Santo Tomas, a locality not maritime but at some distance inland among the mountains; this in 1886, and another by Mr. Brandegee from an inland desert district much further southward; this in 1889. All these specimens, of both collectors, have been distributed for *P. aptera*, yet are not at all of that species. Their respective characters as distinct have been given above.

Of the figure, published in the third volume of Garden and Forest, purporting to represent *P. aptera*, there is somewhat to be said. As to the flowering branch, with immature and not even full-grown foliage, one can but admire its faithfulness to the specimens of the maritime original as in the herbaria; but the right-hand figure represents, first of all, a strong phytologic improbability. In no species of Ptelea is the foliage much more than half grown at flowering time; but here we have the representation of a fruiting specimen with foliage exactly like that of the flowering specimen, even as to size. This can not be true to nature. Again, no herbarium specimens of *P. aptera*—I mean the original, from Punta Banda—had been collected in mature foliage, or even with fruits attached to the branches, at the time that figure was made. Therefore the drawing must be thought of as in a degree fictitious. And a third reason for my thinking it a sad piece of patchwork is that no such fruits as those figured were collected either by Parry or Orcutt, at least at the original station of *P. aptera*. They differ from the originals greatly in size, being nearly three times as large, and they are most different in respect to outline. No one having the least command of botanical terminology could have described those figured as "broadly ovate" or as "round-ovate." Their form is subquadrate-oval; also their margins are evidently obtuse, while in real *P. aptera* they are not only acute but carinately so.

Of the artist's skill and faithfulness to the materials set before him to be put together, there is no question. The character of the tuberculation marking the whole surface of the nut, and so completely unlike that of any genuine Ptelea, is well brought out.

Now, since all the specimens on which this figure is based were collected either by Dr. Parry or Mr. Orcutt, I think it probable that Mr. Orcutt alone collected the fruits figured, and not at Punta Banda, but at some distance inland, namely at Santo Tomas, and in the middle of the month of May, in 1886, or three years and nearly three months later than the date of the gathering of the Punta Banda type. The only sheet I have seen of the Santo Tomas shrub bears specimens in mature foliage, but there is no fruit. On characters of the foliage alone, I have been obliged to make these specimens the type of a new species. But I trust that time and investigation may verify my conjecture that fruits of the garden and forest plate are those of my *P. obscura*.

Dr. Parry's remark that the main difference between the fruit of *P. aptera* and the other species of the genus lay in the absence of the wing, is one that came of a rather superficial examination, and, one would say, of no comparison whatever. The total absence of those transverse rugosities and also of the small resiniferous dots that mark the body of the more genuine species of the genus, are to my mind more significant differences. Another distinction, and one which I note as more important than the absence of a wing is, that, while the seed-bearing part of the typical Ptelea samara is thin, so thin as to rise but a little above the wing on either face, the nut of *P. aptera* is thick and strongly double-convex. Lastly, this nut is dehiscent. Set upon edge and struck with a tack hammer, it splits into two valves as readily as an almond, whereas the seed-bearing body of the samara of ordinary Ptelea can be torn open but with difficulty, and at any other part with less difficulty than along the edges where the sutures ought to be.

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FROM THE

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VOLUME X, PART 3

STUDIES OF MEXICAN AND CENTRAL AMERICAN PLANTS—No. 5

By J. N. ROSE

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PREFACE.

One of the most effective methods of adding to the collections in the National Herbarium is for members of the scientific staff to visit localities little known botanically and themselves make the collections desired. A special advantage of such fieldwork lies in the opportunities it furnishes for making observations on the native uses of plants, on climatic and topographic influences in plant distribution, and on the innumerable other phenomena that distinguish living from dead plants, and especially living plants growing in their natural environment. The botanical reports resulting from such fieldwork are far more critical and more valuable than those based on herbarium specimens alone.

Doctor Rose has made five journeys to Mexico, each of which has resulted in the acquisition of a valuable collection for the National Herbarium and in a published report. Each of these reports, like the accompanying one, covers only fragmentary portions of his whole work. All, however, are devoted to the elucidation of the same general subject, the flora of central Mexico, and together they form a highly valuable series of contributions to our botanical knowledge of that region.

FREDERICK V. COVILLE,
Curator of the United States National Herbarium.

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STUDIES OF MEXICAN AND CENTRAL AMERICAN PLANTS—NO. 5.[a]

By J. N. Rose.

INTRODUCTORY NOTES.

The following studies consist largely of descriptions of new species from the rich gleanings of Dr. C. G. Pringle and Dr. E. Palmer, and of various Government collectors. Of the latter, Messrs. E. W. Nelson and E. A. Goldman continue year after year to send in large accessions. Very large amounts of material have also been obtained by myself and assistants, aggregating now more than 10,000 numbers.

On May 15, 1905, I was authorized by the Assistant Secretary of the Smithsonian Institution to proceed to Mexico for the purpose of making botanical explorations, this being my fifth commission of the kind. Mr. Jos. H. Painter, also of the National Museum, was for the second time sent with me, and his previous experience, together with his enthusiasm for botanical exploration, added greatly to the success of the expedition. My son, Joseph S. Rose, accompanied us as a private assistant. The City of Mexico was made our principal base, and thither we returned repeatedly during the season. We made short trips thence to Tlalpam, San Angel, Santa Fe, Guadalupe, Tlalnepantla, and the Hacienda de la Encarnación, all in the Valley of Mexico; also longer trips to Cuernavaca and Yautepec in Morelos, to Tula, Pachuca, Somoriel, and Tulancingo in Hidalgo, and to Iguala in Guerrero. With Ixmiquilpan, Hidalgo, as a base, work was done on the neighboring mountains and plains, and a side trip was taken to the Sierra de la Mesa, some 20 miles to the east. With San Juan del Rio as a base, a trip was made through the cactus deserts of Querétaro. With Tehuacán, Puebla, as a base, a considerable amount of work was done on the plains and mountains about that town, whence, also, side trips were made to Tomellín and San Sebastián.

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[a] Continued from Vol. VIII, p. 339, of the Contributions.

The following table will show in detail the places visited, the date of each visit, and the number of miles traveled in course of this trip:

Itinerary.

1905.		Miles.
June 30.	City of Mexico to Tlalpam, Distrito Federal, and return	15
July 1.	City of Mexico to Guadelupe, Distrito Federal, and return	10
3.	City of Mexico to Tula, Hidalgo, by rail	50
3–4.	Tula to local stations both east and west	10
4.	Tula to City of Mexico, by rail	50
6.	City of Mexico to Tlalnepantla, Distrito Federal, and return, by rail	15
7–8.	City of Mexico to Hacienda de la Encarnación, Mexico and return, by rail	45
9.	City of Mexico to Sierra Guadelupe and return, by trolley	20
9.	City of Mexico to Yautepec, Morelos, by rail	98
11–12.	Yautepec to pedregal	12
13.	Yautepec to City of Mexico, by rail	98
15.	Mexico to Santa Fe, Distrito Federal, and return, by trolley	20
18.	City of Mexico to Pachuca, Hidalgo, by rail	61
19.	Pachuca to Real del Monte and return	10
20.	Pachuca to mountains northwest of the town and return	5
21.	Pachuca to Hacienda Palmar and return	10
22.	Pachuca to Tulancingo, Hidalgo, and return, by rail	102
24.	Pachuca to Sierra de Pachuca and return	10
25.	Pachuca to Tetepango, Hidalgo, by rail	30
25.	Tetepango to Ixmiquilpan, Hidalgo, by stage	42
26.	Ixmiquilpan to chalk plain west of town	10
27.	Ixmiquilpan to mountains on Zimapan road	10
28.	Ixmiquilpan to mountains south of town	6
29.	Ixmiquilpan to mountains south of town	12
30.	Ixmiquilpan to plain south of town	2
31.	Ixmiquilpan to Sierra de la Mesa, Hidalgo	25
Aug. 1.	Sierra de la Mesa to barranca and return	6
1.	Sierra de la Mesa to Ixmiquilpan	25
2.	Along Ixmiquilpan River	2
3.	Ixmiquilpan to limestone mountain south of town	5
4.	Ixmiquilpan to Tetepango, by stage	42
4.	Tetepango to Pachuca, by rail	30
5.	Pachuca to Somoriel, by rail	29
5.	Somoriel to Las Lajas	6
5.	Las Lajas to Pachuca, by rail	35
6.	Pachuca to City of Mexico, by rail	61
9.	City of Mexico to Iguala, Guerrero, by rail	147
10.	Iguala to local stations, both east and west	10
11.	Iguala to Los Amates and return	18
12.	Iguala to mountains west of town and return	10
13.	Iguala to City of Mexico, by rail	147
14.	City of Mexico to Tlalpam, Distrito Federal, and return, by trolley	15
15.	City of Mexico to San Angel and return, by trolley	10
17.	City of Mexico to San Juan del Rio, Querétaro, by rail	119
17.	San Juan del Rio to red hill west of town	4
18.	San Juan del Rio to local stations, both east and west	10

1905.			Miles.
Aug.	19.	San Juan del Rio to Hacienda de Ciervo	24
	20.	On hills of Hacienda de Ciervo	10
	21.	Hacienda de Ciervo to Cadereyta	9
	22.	Cadereyta to Visaron	15
	23.	Visaron to Higuerillas	12
	24.	Higuerillas to San Pablo	18
	25.	San Pablo to Hacienda de Ciervo	30
	26.	Hacienda de Ciervo to San Juan del Rio	24
	27.	San Juan del Rio to Mexico City, by rail	119
	29.	City of Mexico to Tehuacán, Puebla, by rail	208
	30.	Tehuacán to El Riego	2
	30.	El Riego to limestone hillside	5
	31.	El Riego to hill east of Tehuacán	10
Sept.	1.	El Riego to limestone hillside	5
	2.	El Riego to limestone hillside	5
	3.	El Riego to limestone hillside	10
	4.	El Riego to Tomellín, Oaxaca, by rail	83
	4–5.	Tomellín to canyon and river flats	7
	5.	Tomellín to El Riego, by rail	83
	6.	El Riego to red hills east of Tehuacán	10
	7.	El Riego to San Sebastián and return, by rail	48
	8.	El Riego to mountains west	3
	9.	Tehuacán to Puebla, by rail	79
	10.	Puebla to City of Mexico, by rail	129
	12–13.	City of Mexico to Cuernavaca, Morelos, and return, by rail	148

The herbarium material collected consists of more than 2,000 numbers (8222–10251), a full set of which has been mounted for the National Herbarium. A part of this is reported upon in this paper. Besides the herbarium material some 365 numbers of bulbs, roots, and succulents, the latter consisting chiefly of cacti, were sent to Washington. Many of these are new in cultivation and not a few are undescribed. Not many of the cacti have yet flowered and hence a full list of these introductions can not be given. Most of the plants listed below were collected by me either on my last or on my previous trips to Mexico.

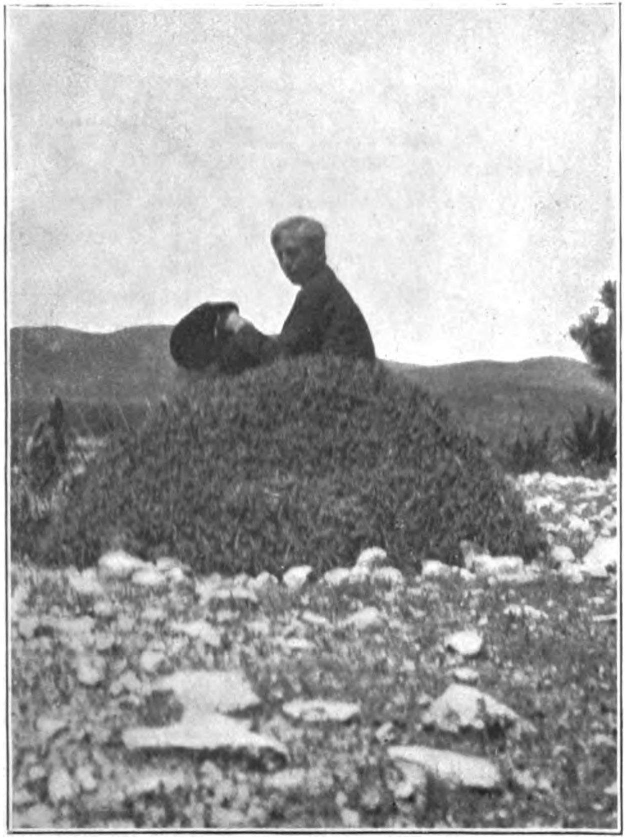
Mexican plants recently introduced by J. N. Rose.—No. 4.

Name.	Catalogue number.	Remarks.
CACTACEAE.		
Cereus hollianus Weber	05. 1305	
Echinocactus flavovirens Scheidw	05. 1289	
Echinocactus ornatus DC	05. 1244	
Echinocactus robustus Link & Otto	05. 1283	
Echinocereus tuberosus Rumph	05. 1001	Flowered in 1906.
Mamillaria carnea Zucc	05. 1139	
Mamillaria elegans DC	05. 1280	
Mamillaria elongata DC	05. 1137	
Mamillaria erecta Lem	05. 1140	

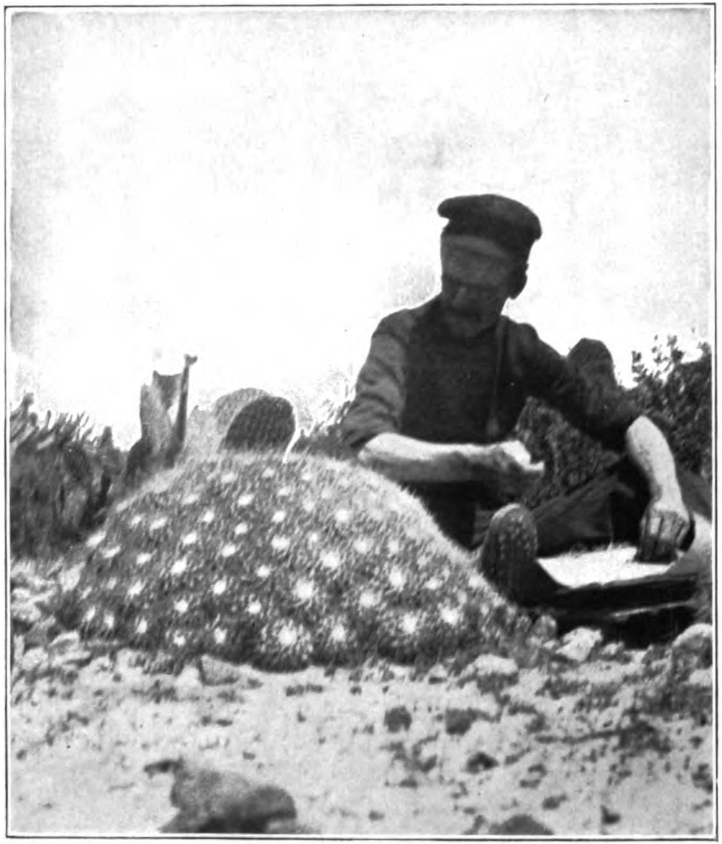
Mexican plants recently introduced by J. N. Rose—No. 4—Continued.

Name.	Catalogue number.	Remarks.
CACTACEAE—continued.		
Mamillaria longimamma DC	05.1144	
Mamillaria mutabilis Scheidw	05.1278	
Mamillaria uncinata Zucc	05.1221	
Opuntia brandegei Schum	06.47	Collected by Mr. E. A. Goldman in Lower California.
Opuntia pilifera Weber	05.1284	
CRASSULACEAE.		
Cremnophylla nutans Rose	838	Flowered in April, 1906.
Echeveria byrnesi Rose	918	
Echeveria campanulata Rose	.....	January, 1905.
Echeveria goldmani Rose	11005	
Echeveria pinetorum Rose	11013	
Echeveria rubromarginata Rose	930	Sent by Doctor Purpus and Mr. Meyers.
Echeveria scopulorum Rose	652	January, 1906.
Echeveria sessiliflora Rose	11012	
Echeveria simulans Rose	767	Sent by Doctor Pringle.
Echeveria tolucensis Rose	957	
Echeveria turgida Rose	962	March, 1906.
Echeveria sp. nov	05.242	Sent by Mr. Maxon from Guatemala.
Echeveria sp. nov	05.319	Sent by Mr. Maxon from Guatemala.
Echeveria sp. nov	05.1164	
New genus near Echeveria	05.1237	
Sedum sp. nov	752	In March, 1906.
MISCELLANEOUS.		
Beaucarnea sp. nov	05.1269	
Calibanus gen. nov	05.894	
Oxalis sp	752	
Dasylirion sp	04.1288	
Dasylirion sp	05.1159	
Dasylirion sp	05.1035	
Dasylirion sp	05.1159	

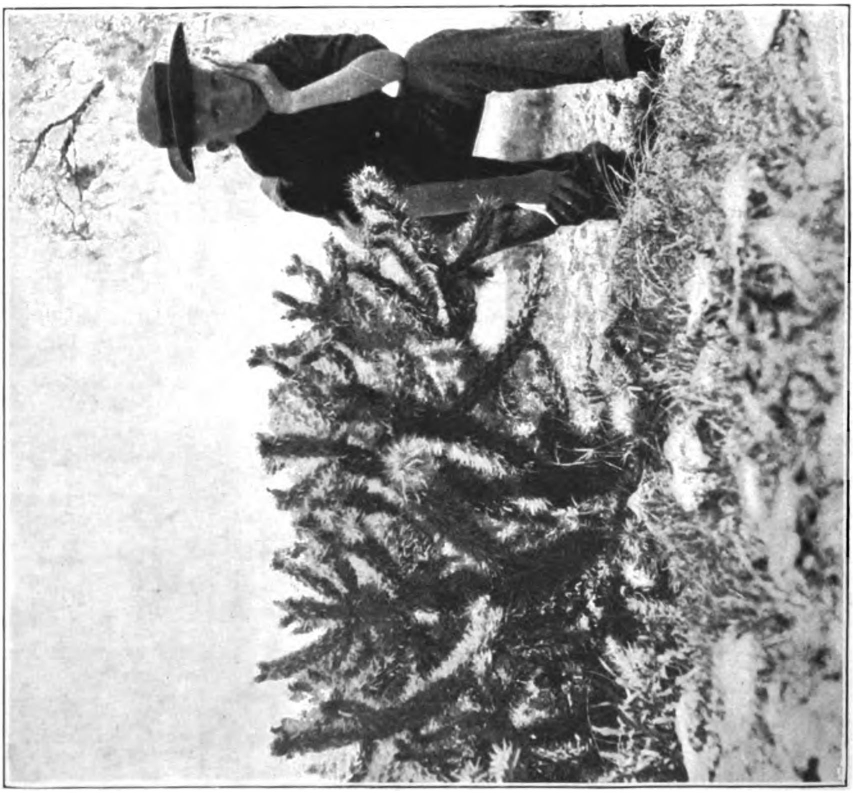
My chief interest being at present in the Cactaceae, these were made the first object of our quest, as a result of which about 150 specimens have been added to the herbarium, while perhaps 200 living specimens were sent to Washington. The most interesting cactus region visited was Ixmiquilpan, where, with the veteran botanical collector, Dr. C. A.



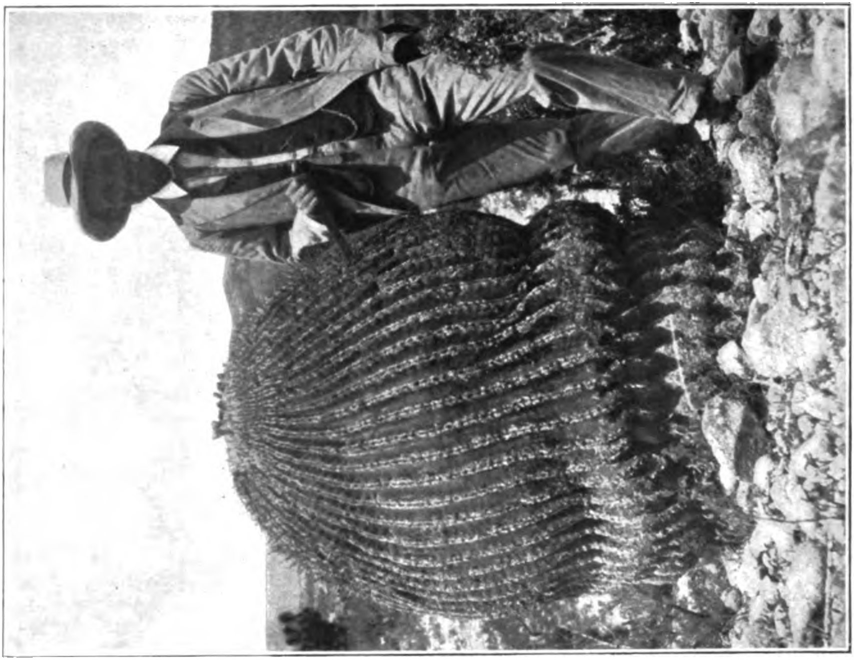
A.—ECHINOCACTUS ROBUSTUS LINK & OTTO.



B.--MAMILLARIA ANGULARIS LINK & OTTO.

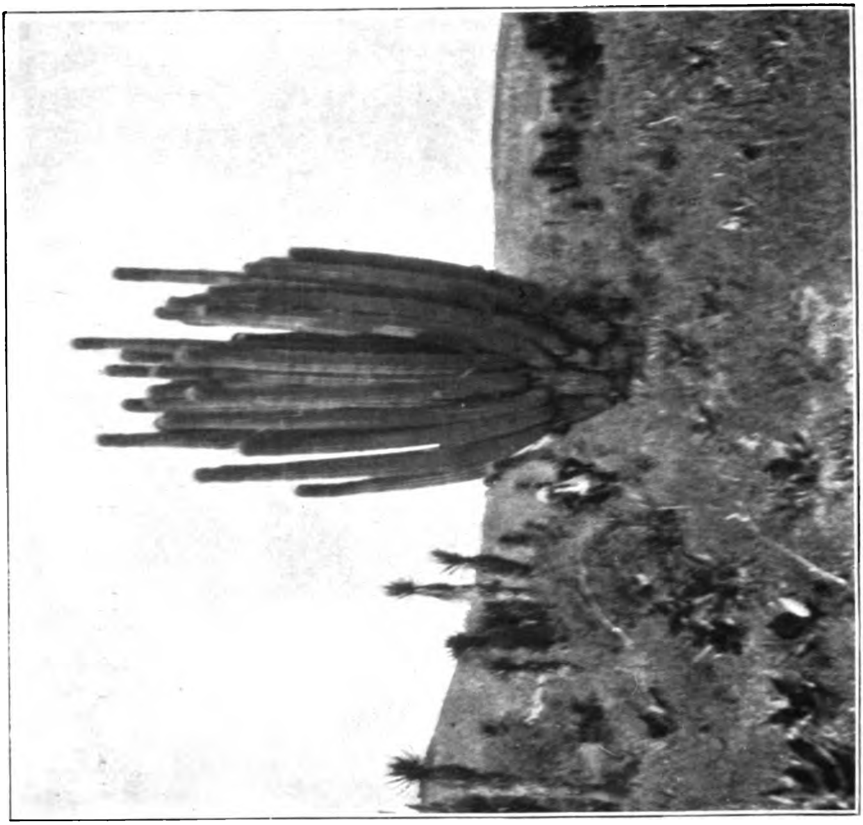


A.—OPUNTIA TUNICATA LINK & OTTO.

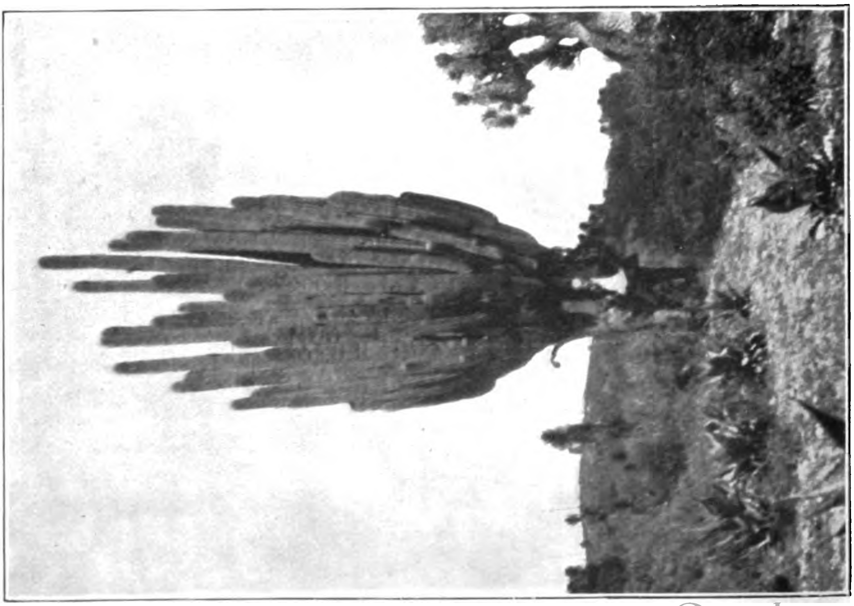


B.—ECHINOCACTUS INGENS ZUCC.

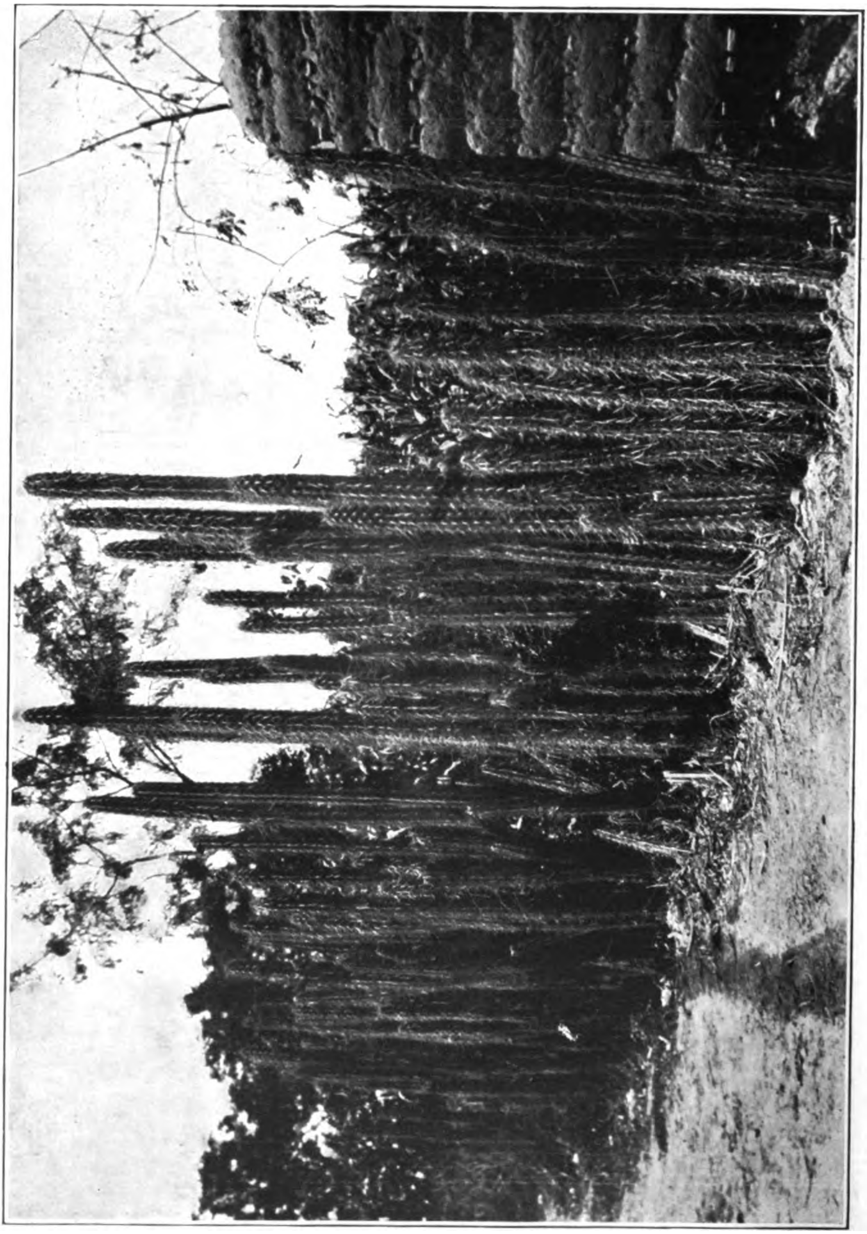
PLATE XVIII.



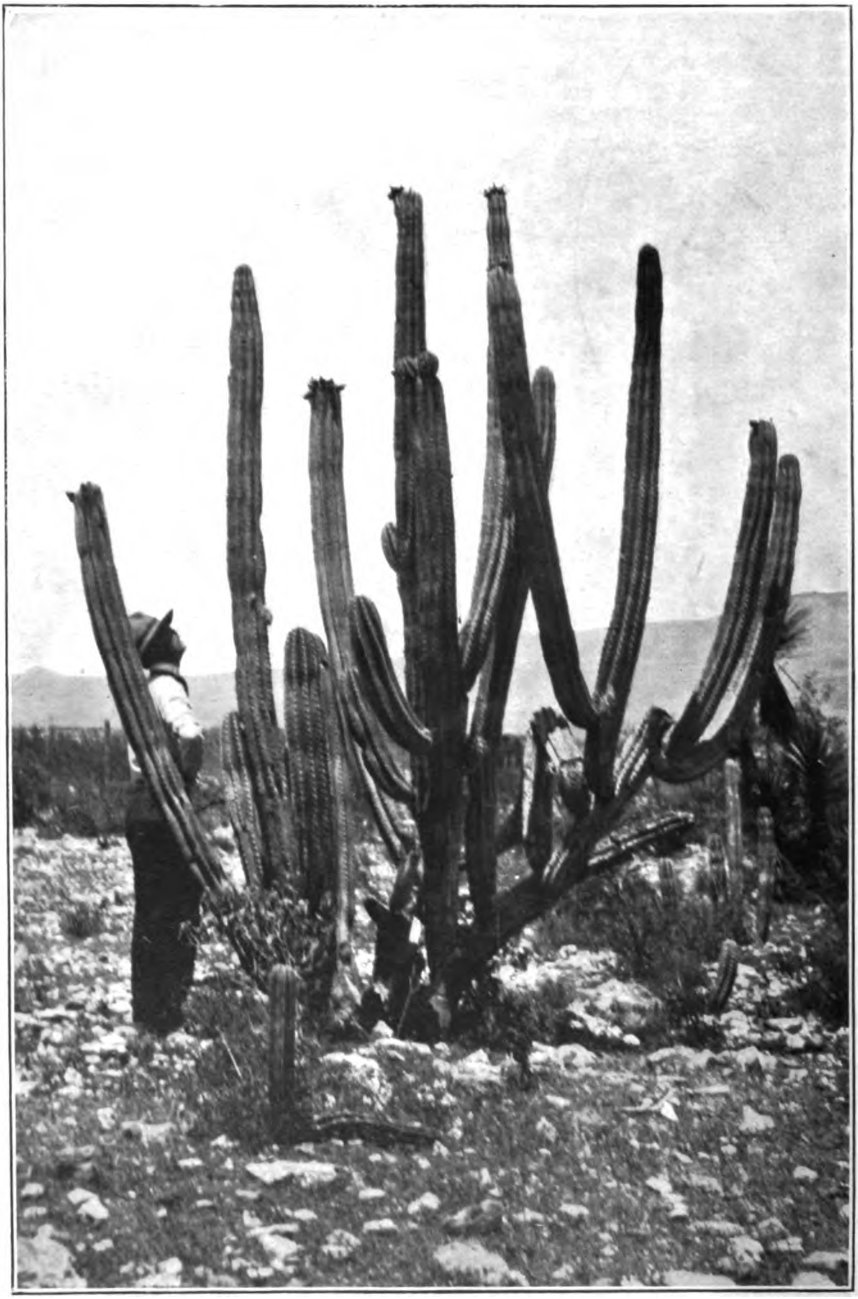
PILOCEREUS FULVICEPS WEBER.



PILOCEREUS FULVICEPS WEBER.



CEREUS HOLLIANUS COULTER.



CEREUS STELLATUS PFEIFFER.

Purpus, as a guide, about twenty species were studied. Here on the dry white chalky plain are found many striking forms. One of the most interesting of these is *Mamillaria angularis* Link & Otto, forming great clumps consisting of many individuals (Pl. XVI). Here is also found a giant Echinocactus (*E. ingens?*), the flesh of which is much employed in making a highly prized confection. The plant grows to be sometimes as much as 2.4 meters tall with a diameter of 90 to 120 cm. The body is cut into sections resembling American cheeses about 60 cm. in diameter and 15 to 20 cm. thick, and these are sent to the candy factory where they are boiled with sugar and made into a candy or "dulce" somewhat resembling preserved citron (Pl. XVII). In the same region *Opuntia imbricata*, *O. tunicata* (Pl. XVII), *O. kleinae*, and other Opuntias were abundant, and here we found a natural hybrid between *Opuntia microdasys* and another Opuntia which has not been specifically identified. Both species were growing near the hybrid. While *O. microdasys* is a low, pubescent, spineless species, the other parent is tall, glabrous, and spiny, and the hybrid is somewhat intermediate in size and without pubescence or spines. So far as my observation goes natural hybrids are not common among the Cactaceae.

Another very interesting cactus desert which we visited is situated around Tehuacán. It is remarkable especially for the great display of tree species belonging to Cereus, Pilocereus, Cephalocereus, and Opuntia. The cactus species of all genera seen here numbered 22.

Two species of Echinocactus (*E. flavescens*, *E. robustus* (Pl. XVI)) form great clumps, very much larger than any I had ever seen before. In the case of *E. robustus* it was not uncommon to see masses 1 to 1.3 meters high and 3 meters in diameter, and in one example nearly 5 meters in diameter. These masses must have contained hundreds, if not thousands, of individuals. A photograph of *E. robustus* is here reproduced.

On the hills east of the town are great forests of the huge *Cephalocereus macrocephalus* (Pl. XLIII, facing p. 126), which in many respects resembles the much better known *Cephalocereus senilis.* Unlike the latter, however, it develops a very woody trunk. Another striking species is *Pilocereus fulviceps* (Pl. XVIII), which has a short, stout, woody trunk and hundreds of nearly erect branches reaching a height of 12 to 15 meters. These branches set very close together and form a cylindrical mass, not infrequently 5 meters in diameter.

Pilocereus chrysomallus, which grows to the height of 2 to 3 meters, is a common plant, while *Cereus hollianus* (Pl. XIX) is so common as to be used as a hedge plant. Its fruit is as large as a goose egg. Another Cereus near *C. stellatus* (Pl. XX) is very common and furnishes fruit for the market. *Escontria chiotilla* (Pl. XLIII, facing p. 126)[a] is still another of the tree cacti here found. This species produces small yellow flowers and a fruit clothed with thin papery scales. The fruit is a common article in the markets, sold under the names of chiotilla, "geotilla," tuna, etc. Here, and farther south, near Tomellín Cañon, is perhaps the real giant of the cactus family. A single tree often produces hundreds of nearly erect branches, and the quantity of material wrapped up must amount to many tons. Unfortunately I failed to find it either in flower or in fruit, but its habit, spines, etc., would indicate that it is a near relative of *Cereus pecten-aboriginum* (Pl. XXI), which I have found as far inland as Cuernavaca. This plant, doubtless, like many other cacti, has two or more names already.[a] Hardly less interesting was the little *Pelecyphora pusilla*, which had recently been discovered also by Doctor Purpus near Tehuacán. For nearly a week we explored hill after hill and not until we were completely discouraged did we find this little plant on the top of a hill almost hidden in the gray pebbles and sand.

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[a] See p. 126.

A third cactus region explored was in the desert of Querétaro. Fitting out at San Juan del Rio we traveled northeast to Cadereyta and then east toward Zimapan as far as Higuerillas, thence north nearly to Tolomán, returning by the way of Cadereyta to San Juan del Rio. On this trip 36 species were examined, of which 9 were Opuntias and 15 were Mamillarias. The so-called *Mamillaria clava* was especially abundant, often forming clumps of 50 or more plants each 2 feet high. Each plant would have 10 to 12 large yellow flowers open at one time, the whole clump thus making a most gorgeous display. Many fine specimens of *Echinocactus ornatus* were seen, but unfortunately only a single living specimen reached Washington. In the same desert were found *Echinocactus grusonii*, *E. turbiniformis*, and *E. ingens*.

Perhaps the most interesting rediscovery made was that of the *Fouquieria spinosa* of Humboldt, Bonpland, and Kunth, or, as it is now called, *F. fasciculata*. Nearly ten years ago, while making some preliminary studies on the genus Fouquieria, I looked up Humboldt's original station and found it to be in the State of Hidalgo. Since then every proposed itinerary of mine in Mexico has included a trip to this type locality, but as the station is far from railroad connections the trip has repeatedly been given up. I had looked in vain for the plant in the dry parts of Hidalgo. Inquiry was made of botanical collectors in Mexico, but without success. The species has therefore remained a prominent desideratum.

It will be recalled that as long ago as 1844 Mr. Bentham referred a plant from southern Lower California to *F. spinosa* and various specimens since collected in Lower California and western Mexico have accordingly thus been labeled. To those at all familiar with the floral

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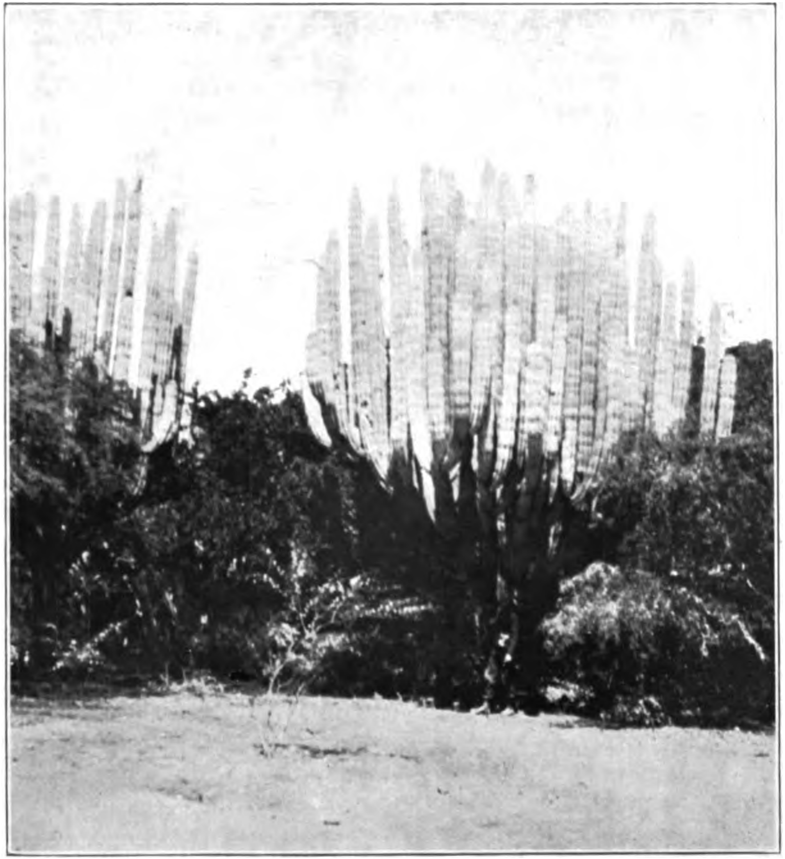
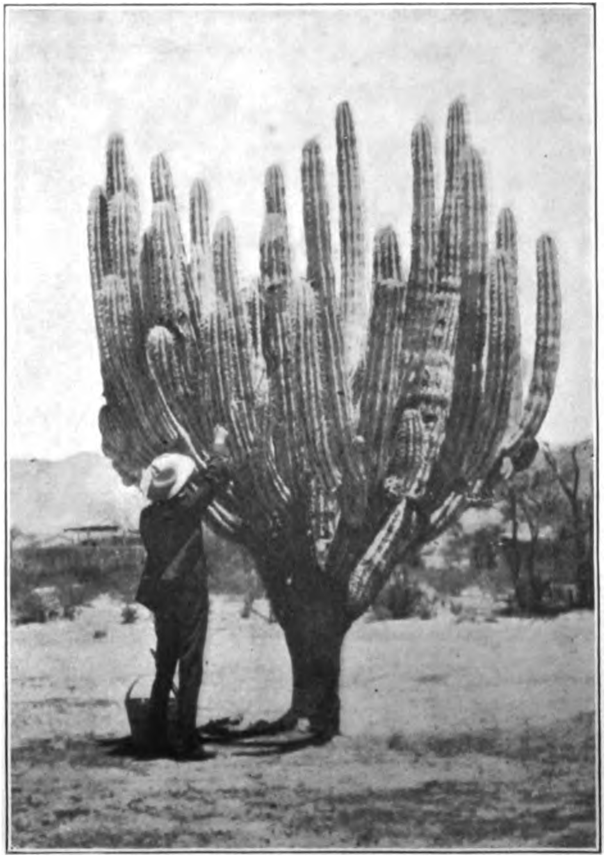
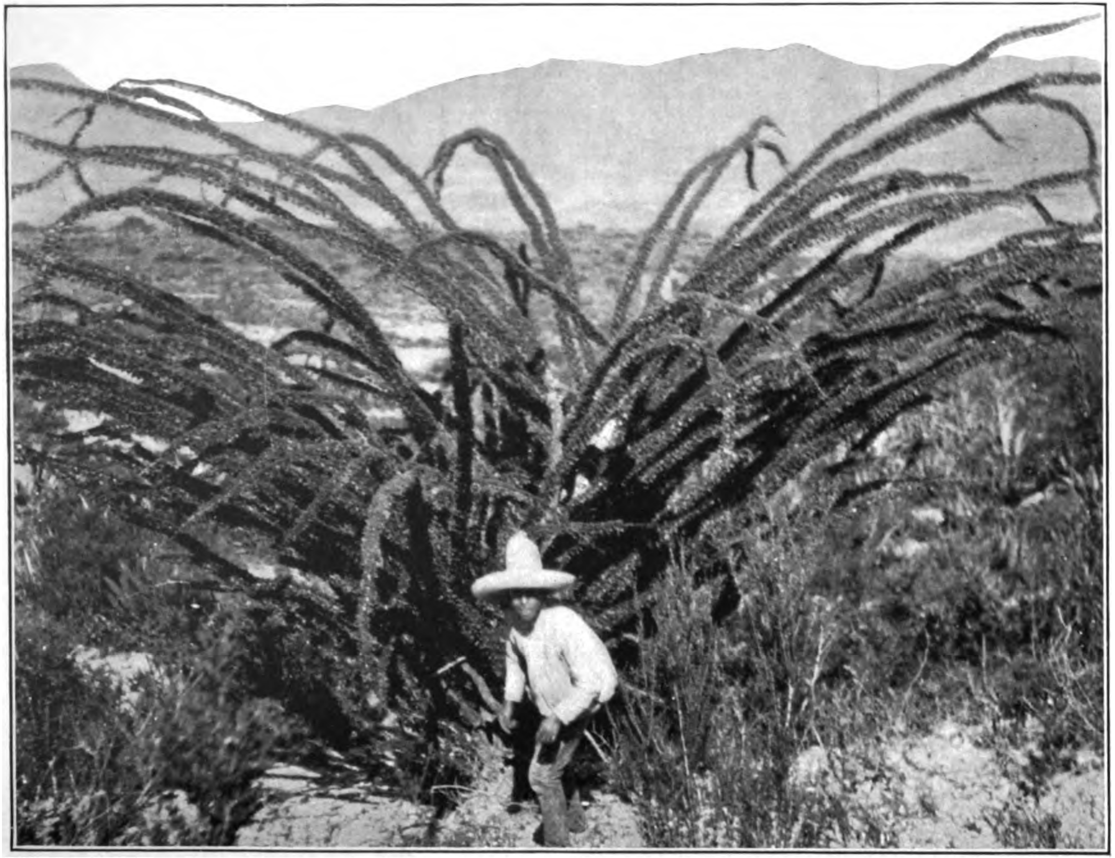
[a] Later determined as *C. weberi*.



CEREUS WEBERI COULTER.



CEREUS WEBERI COULTER.



FOUQUIERIA SPINOSA H. B. K.

regions of Mexico such a distribution of the species seems most unnatural. This western material has been segregated by Mr. Nash under the name of *F. peninsularis* and *F. macdougalii*. While planning for the trip to Ixmiquilpan I learned from Dr. C. A. Purpus that there was a Fouquieria along the stage road from Tetepango to Ixmiquilpan. As this road runs near Actopan I felt convinced that this was the plant for which I had so long been looking. During the stage ride of 40 miles only a single specimen was observed, but this fortunately was a very fine one. A photograph of it is here shown (Pl. XXII). Some days afterwards while making an excursion some 20 miles east of Ixmiquilpan we found this species in great abundance growing on the hills with the oldman cactus, *Pilocereus senilis*, and with *Dasylirion quadrangulatum*. And again while making our trip through the desert of Querétaro we found the plant growing profusely on the dry hills and on the walls of the canyons. Among the poor natives it is known as *chiquiña*. They use the stems for the sides of their rude huts and to form first a fence and then a hedge about their yards. The stems are placed close together forming a compact paling, well defended by the sharp recurved spines which are revealed after the leaves fall off. The stems easily root and then form a permanent hedge. It is not uncommon to see the naked stems giving off bright red clusters of flowers from their upper axils. The photograph gives a good idea of the habit of the plant. The material collected, of which there is an abundance, shows that the species instead of being the most remote is perhaps the nearest relative of *Fouquieria formosa*. The material, although not yet critically studied, also indicates that it is very close to *Fouquieria campanulata*.

At Ixmiquilpan we collected material of the so-called *Dasylirion hookeri*, which has led to the ascertainment of the real identity of this very curious plant. It was long ago (1859) figured in the Botanical Magazine and wrongly referred to *Dasylirion hartwegi*. Then it seems to have been lost sight of until 1904, when a specimen was sent to Washington by Mr. C. R. Orcutt from San Luis Potosí. This specimen being without flowers, fruit, or foliage, its relationship could only be guessed at. In habit it resembled a great puffball with a thick corky bark like that of an oak and of a loose cellular structure within. Later in the year the Department of Agriculture commissioned Dr. E. Palmer to collect the plant near San Luis Potosí. Some 10 or 12 fine specimens were received from him, but these have remained perfectly dormant up to the present. Having learned from Doctor Purpus that he had seen a similar plant near Ixmiquilpan, when I visited that place, a day was spent with him in hunting for it in its habitat on the tops of mountains. Specimens are not at all common and so much do they resemble moss-covered bowlders or old stumps that one may easily overlook them. Flowers were collected, and later Doctor Purpus sent me fruit. These show clearly that this plant is distinct from both Dasylirion and Nolina, though much nearer the latter.

About Tehuacán two remarkable species of Beaucarnea were discovered, both of which seem to be undescribed. One of them has a most singular trunk, at first nearly globular but afterwards sending up a slender stem which becomes more or less branched. The swollen base takes on a multitude of shapes, but is always very large as compared with the rest of the plant. One such measured at 0.6 meters above the base, 6.3 meters in circumference, and at 1.8 meters above the base contracted abruptly into the slender stem proper. The basal expansion is made up of very loose cellular tissue which when dead and dry is almost as light as cork. This club-footed base suggests the specific name used elsewhere in this paper for this species. The aspect of the plant is shown in Pl. XXIII, facing page 88.

Dasylirion quadrangulatum S. Wats., while perhaps not uncommon in cultivation, is not often met with even in our larger herbaria. This species was found to be very common in eastern Hidalgo and the drier parts of Querétaro. It forms a very distinct trunk 120 to 150 cm. long below the crown of leaves and sends up a flowering stem 3.6 to 4.5 meters long. The leaves are very unlike those of all the other species, being very thick and narrow and not prominently saw-toothed. They are often 3 meters long. In some parts of Querétaro the natives use them as a thatch for their houses. They call the plant junquillo.

Material of the small parasite Pilostyles (or Apodanthes) of the Rafflesiaceae was collected at five localities, two near Ixmiquilpan, one in the desert of Querétaro, and two near Tehuacán. Whether more than one species was obtained I have not yet determined, but there were two or three hosts, each being some species of Parosela.

According to Doctor Robinson Pilostyles has been reported only three times from North America, once by Geo. Thurber and twice by Dr. C. G. Pringle. Material was collected, however, by Mr. Frederick V. Coville in Texas in 1904 and by Dr. E. Palmer in San Luis Potosí in 1905. This genus, in North America at least, is always parasitic on some genus of Viciaceae, generally on Parosela. The plants are minute, reduced simply to flower parts, which may account for the fact that the species have been so very rarely collected. Unless one has seen specimens or is looking particularly for them he will readily pass them by as secretions or insect work.

All new species here described are based upon specimens in the United States National Herbarium and when two or more collectors are cited the type specimen is definitely stated.

The line drawings are the work of Miss Juliet C. Patten, except that plate 25 was made by the late Frederick A. Walpole and plate 40 by Homer D. House.

LILIACEAE.

DASYLIRION AND ITS ALLIES.

After passing in review the specimens and descriptions of Dasylirion and Nolina I have become convinced that certain species should be excluded from both and brought together into a third genus. Some of these species have long been known as Beaucarnea and are an attractive sight in every large conservatory.

The discovery of female flowers and mature fruits of the so-called *Dasylirion hookeri* furnishes data which justify its segregation also.

The following key will point out the essential differences in these genera:

Ovary 1-celled; fruit strongly 3-winged.
  Stems strongly bulbose at base; leaves never saw-toothed; inflorescence a broad open panicle .... BEAUCARNEA.
  Stems never bulbose at base; leaves saw-toothed (except in one species); inflorescence an elongated spike-like panicle......... DASYLIRION.
Ovary 3-celled; fruit not at all winged.
  Fruit not 3-lobed, its walls very thick and woody, not dropping away; trunk a swollen globular body......................... CALIBANUS.
  Fruit strongly 3-lobed, its wall very thin, soon dropping away; trunk if present never swollen .... NOLINA.

BEAUCARNEA.[a]

The genus Beaucarnea was described by Lemaire in 1861 with *B. recurvata* as the type. Two other species (*B. striata* and *B. gracilis*) were also described by him. In 1872 and also in 1881 J. G. Baker monographed the genus, combining with it the much older genus Nolina. He describes twelve species and several varieties. In 1875 S. Watson monographed the United States species of Nolina, stating that the Mexican species of Beaucarnea described by Mr. Baker should doubtless be referred to Nolina. Three years after Mr. Baker's last paper Mr. Hemsley again takes up the name Nolina, and so the two names have been alternating, first one and then the other receiving the sanction of botanists. In America the name Nolina, being much the older, has generally been accepted by botanists, while gardeners throughout the world have, as a rule, clung to Beaucarnea.

After a careful study of the species along with those of Dasylirion it seems clear that both genera should be retained. For at least two accepted species of Dasylirion with several referred to Beaucarnea and Nolina form a very natural genus abundantly distinct from both Nolina and Dasylirion. The genus Beaucarnea has the inflorescence and foliage similar to those of Nolina while the fruit is much like that of Dasylirion; hence heretofore those species of Beaucarnea known only from foliage or flowering specimens have been referred to Nolina while those collected in fruit have been described as Dasylirion. Beaucarnea rarely flowers in cultivation and, being dioecious or nearly so, its fruit has rarely if ever been obtained.

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[a] BEAUCARNEA Lemaire, Illust. Hortic. 8: Misc. 57. *pl. 303.* 1861. Type species *B recurvata.*

Monographers therefore have associated Beaucarnea and Nolina together because of the similarity of their leaves.

Beaucarnea guatemalensis Rose, sp. nov. FIGURE 1.

Tree, 6 to 12 meters high with a thickened bulbous base abruptly contracted into a slender stem 5 to 8 cm. in diameter; swollen base covered with a thick corky bark 6 cm. thick; upper part of stem smooth and with very thin bark; leaves numerous, clustered at the top as in the common cultivated Beaucarneas, erect (?), broad at base (4 to 5 cm. broad), 10 to 15 mm. broad immediately above the base, 25 mm. broad 20 cm. from base, gradually tapering upward into a long filiform tip 60 to 80 cm. long, the margin entire; male inflorescence an open panicle, 75 to 110 cm. long; female inflorescence not seen; fruit 15 mm. long, strongly 3-winged; wings thin, 4 to 5 mm. broad.

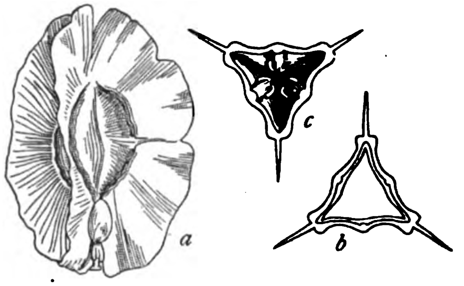


FIG. 1.—Fruit of *Beaucarnea guatemalensis*. *a*, Side view: *b*, cross section showing seed; *c*, cross section showing undeveloped ovules at base. All scale 2.

Type specimen U. S. National Herbarium no. 474781, collected by W. A. Kellerman in a rocky ravine on the south side of the Sierra de las Minas, opposite El Rancho, Guatemala, altitude about 600 meters, on March 10, 1905 (no. 4320).

This species belongs with *B. inermis* and *B. pliabilis*, but the fruit is broader-winged than in the former and the leaves are broader than in the latter.

Beaucarnea inermis (S. Wats.) Rose. FIGURE 2.

Dasylirion inermis S. Wats. Proc. Am. Acad. **26**: 157. 1891.

This remarkable tree, although common in its native haunts, has until very recently only been known from the specimens obtained by Dr. C. G. Pringle near Las Palmas in the low lands of San Luis Potosí. Dr. E. Palmer collected it in 1905 in this same general region. The writer observed it in 1899, but obtained no specimens.

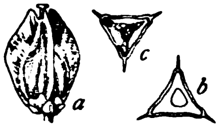


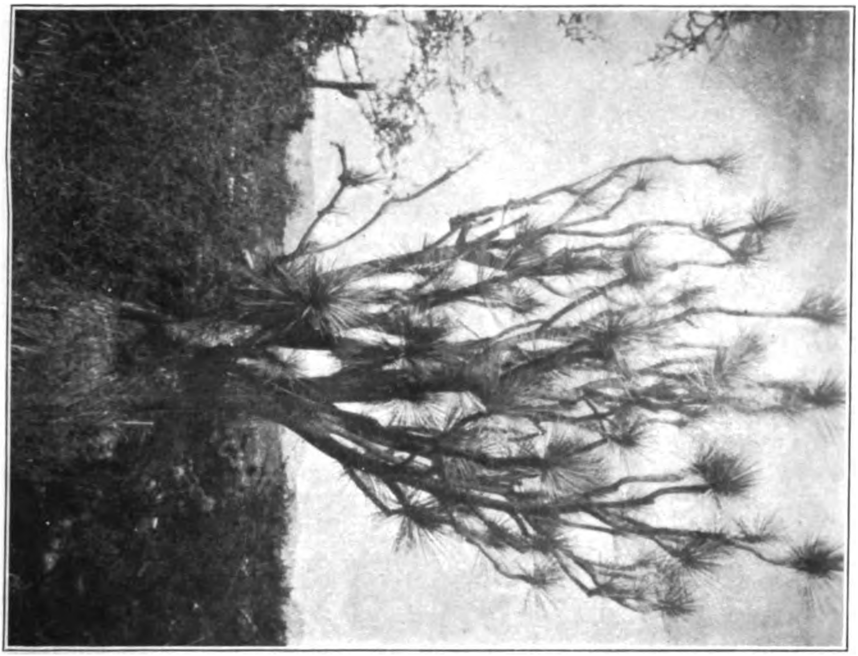
FIG. 2.—Fruit of *Beaucarnea inermis*. *a*, Side view; *b*, cross section showing seed; *c*, cross section showing undeveloped ovules at base. All scale 2.

Beaucarnea oedipus Rose, sp. nov. PLATE XXIII.

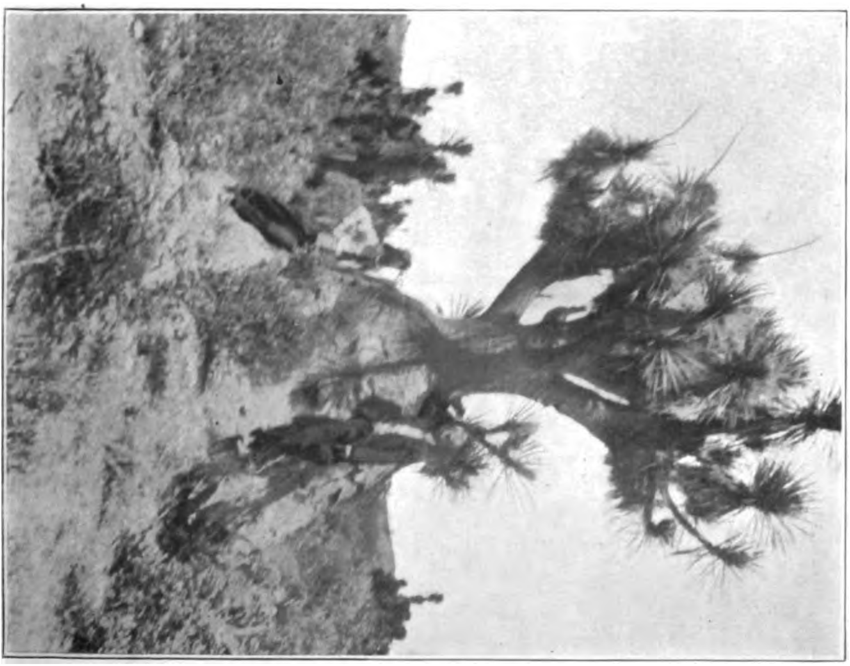
Trees 6 to 12 meters or more high; the base variously and enormously enlarged, at first a globular body crowned by a clump of leaves but in very old plants more or less dome-shaped and 1 to 2 meters high by 2 to 7 meters in circumference; the trunk above the base comparatively slender, often much branched, each branch crowned by a cluster of slender leaves; leaves erect, linear, 25 to 40 cm. long, 4 to 6 mm. broad above the base; inflorescence paniculate; fruit 3-winged.

Type U. S. National Herbarium no. 453660, collected by J. N. Rose and Jos. H. Painter on hills near Tehuacán, Puebla, August and September, 1905 (no. 10157). Also collected from the same station by Dr. Wm. Trelease, August, 1903, and by Dr. C. R. Purpus, 1905.

PLATE XXIII.



BEAUCARNEA OEDIPUS ROSE.



BEAUCARNEA OEDIPUS ROSE.

Beaucarnea pliabilis (Baker) Rose.

Dasylirion pliabile Baker, Journ. Linn. Soc. **18:** 240. 1881.

B. pliabilis has heretofore only been known from Schott's specimen collected many years ago at Sisal, Yucatan. In 1902 Mr. E. A. Goldman collected leaves and took photographs of this species at Progreso not far from Sisal. These indicate a species closely related to *B. guatemalensis*, but the leaves are shorter and perfectly smooth and evidently belong to a quite distinct plant.

Collected by E. A. Goldman at Progreso, Yucatan, February 24 to March 5, 1901 (no. 607, photograph no. 2211).

Beaucarnea purpusi Rose, sp. nov.

Tree 6 to 8 meters high, somewhat swollen at base, a little branched, the trunk almost completely clothed by the reflexed and closely appressed old leaves; leaves at first erect, then spreading, and at last reflexed, long-persisting, very pale, 50 to 60 cm. long, 10 to 12 mm. broad, the margin pale and entire.

Type specimen U. S. National Herbarium no. 453659, collected by J. N. Rose and Jos. H. Painter near Tehuacán, Puebla, in 1905 (no. 10156).

Beaucarnea recurvata Lemaire, Illust. Hortic. **8:** Misc. 59. 1861.

Beaucarnea recurvata was introduced into cultivation from Mexico about 1845, but the station from which it was obtained is not known. The specimen cited under this name in the Biologia Centrali-Americana belongs to a true Nolina, *N. altamiranoana*.

Beaucarnea stricta Lemaire, Illust. Hortic. **8:** Misc. 61. 1861.

Beaucarnea stricta is a glaucous-leaved species, only known from garden specimens. It is often confused with *Nolina hartwegiana* and *B. recurvata*. *Beaucarnea glauca*, another garden plant, may or may not belong here.

DASYLIRION.[a]

After excluding the species belonging to Nolina and Beaucarnea eleven species still remain belonging to Dasylirion. Some of these are not very well known. Below is given a list of them with the description of one that is new.

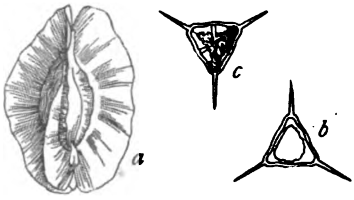


FIG. 3.—Fruit of *Dasylirion quadrangulatum*. *a*, Side view; *b*, cross section showing seed; *c*, cross section showing undeveloped ovules at base. All scale 2.

Dasylirion acrotrichum Zucc. Abh. Akad. Muench. **3:** 228. 1843.

Dasylirion berlandieri S. Wats. Proc. Am. Acad. **14:** 249. 1879.

Dasylirion flexile C. Koch, Ind. Sem. Hort. Berol. **1867:** app. 1. 5. 1867.

Dasylirion glaucophyllum Hook. Bot. Mag. **84:** *pl. 5041.* 1858.

Dasylirion graminifolium Zucc. Abh. Akad. Muench. **3:** 225. 1843.

Dasylirion longissimum Lem. Illustr. Hortic. **3:** Misc. 91. 1856.

Dasylirion quadrangulatum S. Wats. Proc. Am. Acad. **14:** 250. 1879. FIGURE 3.

Dasylirion serratifolium Zucc. Abh. Akad. Muench. **3:** 225. 1843.

Dasylirion texanum Scheele, Linnaea **23:** 140. 1850.

Dasylirion wheeleri S. Wats. Proc. Am. Acad. **14:** 249. 1879.

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[a] DASYLIRION Zucc. Otto & Dietr. Allg. Gartenz. **6:** 258. 1838.

Dasylirion lucidum Rose, sp. nov.

Stems one to two meters high, crowned by a cluster of leaves; leaves 40 to 60 cm. long, 12 to 13 mm. broad above the enlarged base, greenish-yellow, smooth and shining on both surfaces, the marginal teeth reddish brown, the edge serrulate between the teeth, the apex resolving into a long tuft of fibers; inflorescence paniculate, 2 to 3 meters high including the peduncle; male racemes rather slender, 5 to 6 cm. long; fruiting panicle narrow and dense, the racemes appressed to the main axis; pedicels short, articulated near the apex; perianth lobes 2 mm. long, obtuse; fruit 7 mm. long, 5 mm. broad, rounded at base, retuse at apex, 3-winged, the wings rounded at apex and distinct from the short but evident style; ovules 6; seeds one, somewhat 3-angled in section.

Type U. S. National Herbarium no. 453508, collected by Rose and Painter on the limestone hills west of Tehuacán, Puebla, September 1, 1905 (no. 10009), and in flower earlier the same year (June) by Dr. C. A. Purpus (no. 1253a).

This species is perhaps nearest *D. serratifolium* but is certainly distinct, that species having broader scabrous, yellow-spined, and dull-colored leaves. J. G. Baker states that the wings are adnate to the style, but an examination of the figure cited by him does not clearly bear this out. I find no record of fruit having been collected by anyone except Karwinsky.

CALIBANUS.

Calibanus Rose, gen. nov.

Plants dioecious; flowers, both male and female, arranged in short and broad panicles; perianth segments 6, orbicular, obtuse; stamens 6, only slightly exserted; ovary 3-celled, 6-ovuled; fruit globular, 1-seeded, thick-walled, not bursting when ripe; seed globose or somewhat 3-angled; trunk a large globular body covered with thick bark; leaves appearing in fascicles over the surface, linear, entire or serrulate to the touch; panicles arising with the leaf clusters, leafless.

This genus is nearest Nolina, but differs greatly in its habit and in its globular, thick-walled, 1-seeded fruit. It is very different both in habit, inflorescence, and fruit from Dasylirion, to which it has long been referred. Its globular trunk suggests Beaucarnea, in which it was once placed by J. G. Baker, but its fruit excludes it from that genus.

The genus is named for Shakespeare's Caliban.

Calibanus caespitosus (Scheidw.) Rose. PLATES XXIV, XXV. FIGURE 4.

Dasylirion caespitosum Scheidw. Wochenschrift Verein Gartenb. **4**: 286. 1861.

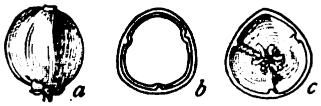


FIG. 4.—Fruit of *Calibanus caespitosus*. *a*, Side view; *b*, cross section showing seed; *c*, cross section showing undeveloped ovules at base. All scale 2.

Dasylirion hookeri Lemaire, Hort. Belg. **15**: 324. 1865.

Beaucarnea hookeri Baker, Journ. Bot. **1872**: 327. 1872.

Plant body proper 30 to 100 cm. in diameter covered with a thick corky bark like that of an oak, within of loose cellular structure, resting upon the ground like a puffball and attached to the earth only by small fibrous roots; leaves 30 to 90 cm. long, linear, 2 to 2.5 mm. broad, pale green, slightly serrulate, striate; panicle 10 to 20 cm. long, about 10 cm. broad, the horizontal branches quite rigid; segments of the flower orbicular, scarious-margined, purplish; fruit 5 to 7 mm. in diameter.

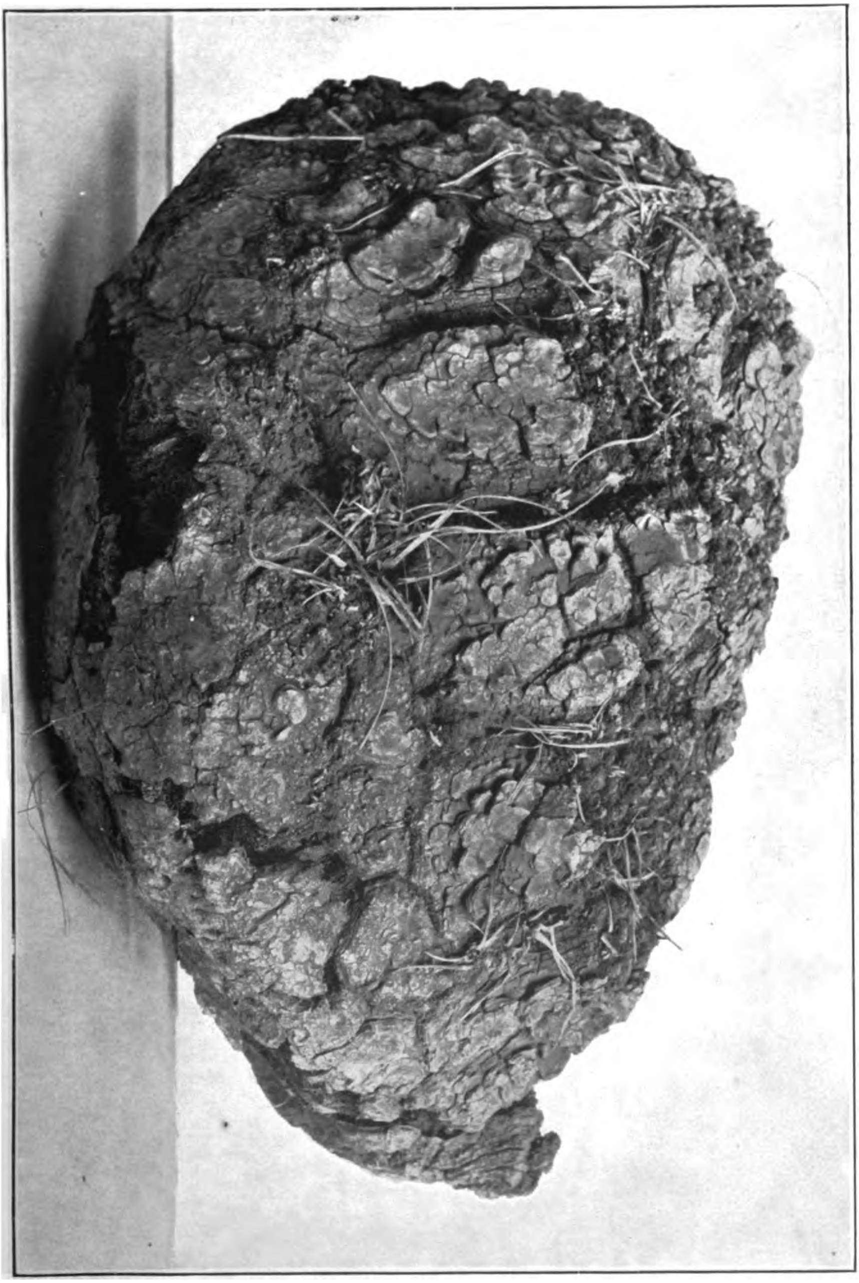
Specimens examined:

San Luis Potosí: Near City of San Luis Potosí, C. R. Orcutt, 1903 (trunk only); Dr. E. Palmer, 1905 (numerous plants but no flowers).

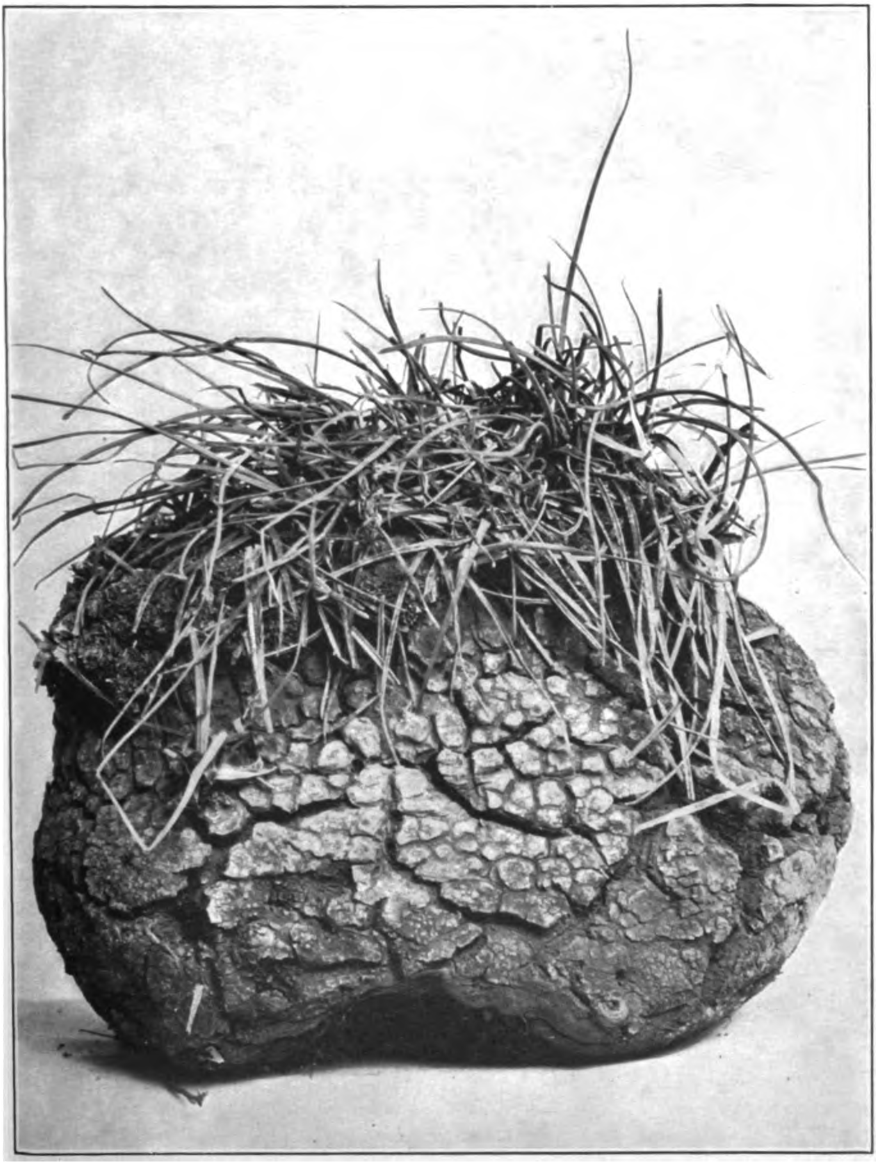
Hidalgo: Near Ixmiquilpan, Rose & Painter, 1905 (no. 8954) with male and female flowers and immature fruit; Dr. C. A. Purpus, same date and place; also later, in fruit.

This plant was illustrated in the Botanical Magazine for 1859 (*pl. 5099*) under the name of *Dasylirion hartwegianum*, the plate being accompanied by the following note:

PLATE XXIV.



CALIBANUS CAESPITOSUS (SCHEIDW.) ROSE.



CALIBANUS CAESPITOSUS (SCHEIDW.) ROSE.

About the year 1846, we received from Mr. Repper, of the Real del Monte Company's establishment, Mexico, some remarkable plants in the form of tubers, a foot and half long, and nearly as high aboveground, the surface of which is formed by a number of wrinkled tubercles, slightly elevated, and somewhat circinately wrinkled; from a few of which appeared tufts of rigid, subulate leaves, 1 to 2 feet long, in form and texture resembling those of some Dasylirium. The general aspect of the tubers remind one of the well-known "Elephant's-foot" of South Africa, or of some remarkable Dioscoreae which we cultivate from Mexico. These remained dormant for some years, but one of them has lately produced more copious tufts of foliage and panicles of flowers; and precisely accord (the female flowers are, however, wanting to our plants) with the *Dasylirium Hartwegianum* of Zuccarini, which Hartweg sent from Zacatecas, in Mexico; and a Dasylirium of Mr. Charles Wright ("Coll. N. Mex. 1851-2"), n. 1918, also seems to be identical; but neither of these collectors has made a note on the nature of the plant, so that whether we are to consider this tuber as the normal condition of the stem or caudex of this species, or whether we are to look upon it as an accidental collection or congeries of united stems (a kind of monstrosity), still remains a doubt in our minds. All the Dasyliria yet known to us have separate, unbranched, and distinct stems, more or less elongated, as in the caulescent species of Agave, and as may be seen in our figures of two of the species of this remarkable genus, at our Tab. 5030 and Tab. 5041. The flowers of the panicles develop themselves very slowly, and the withered stalks and branches remain a long time attached to the trunk. Mr. Bentham compares this plant with the *Cordyline longifolia* of H. B. K.; but the very large, almost sheathing bracteas, rather than leaves (which latter do not appear in the figure given by Humboldt), and the widely different ramification of the panicle, and the acuminated sepals, indicate something very different.

NOLINA.[a]

The genus Nolina as first described contained but one species, viz, *N. georgiana*, which therefore is the type of the genus. After excluding from Nolina those species which belong to Beaucarnea we have left twenty species, as follows:

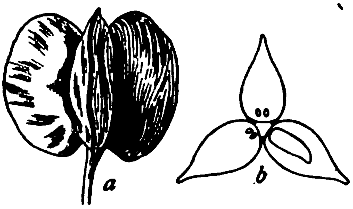


FIG. 5.—Fruit of *Nolina altamiranoana*. *a*, Side view; *b*, cross section showing seed in one cell and undeveloped ovules in two. Both scale 2.

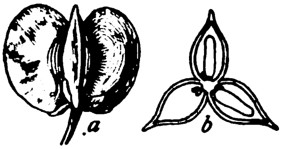


FIG. 6.—Fruit of *Nolina elegans*. *a*, Side view; *b*, cross section showing seeds in two cells and undeveloped ovules in all. Both scale 2.

Nolina altamiranoana Rose, Proc. Nat. Mus. **29**: 438. 1905. FIGURE 5.

Nolina beldingi Brandegee, Zoe **1**: 305. 1890.

Nolina bigelovii (Torr.) S. Wats. Proc. Am. Acad. **14**: 247. 1879.

Nolina brittoniana Nash, Bull. Torr. Club **22**: 158. 1895.

Nolina elegans Rose, sp. nov. FIGURE 6.

Probably acaulescent; leaves 50 to 60 cm. long, 9 to 12 mm. broad, stiff, yellowish, both surfaces smooth, the margins serrulate; inflorescence a narrow panicle, 1 to 3 meters long; flowering branches ascending; bractlets scarious, their margins lacerate; pedicels 8 to 9 mm. long, jointed a little above their base; sepals obtuse, scarious-margined; fruit strongly 3-lobed, 7 to 10 mm. broad, broader than high, the walls thin but not bursting before the ripening of the seeds.

This species is probably common in the mountains of Chihuahua, Durango, and Zacatécas.

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[a] NOLINA Michx. Fl. **1**: 207. 1803.

Type specimen U. S. National Herbarium no. 301306 (J. N. Rose, no. 2396).

Specimens examined:

Zacatecas: In the mountains, J. N. Rose, August 18, 1897 (no. 2396).

Durango: Dr. E. Palmer, 1896 (no. 249); E. W. Nelson between El Oro and Guanacevi, August, 1898 (no. 4745).

Chihuahua: Townsend & Baker, near Colonia Garcia, June, 1899 (no. 76).

Nolina elegans has been confused in collections with both *N. microcarpa* and *N. recurvata*. From the former it differs in its broader, stiffer leaves, larger fruit, etc. From the latter it is generically distinct, and it is needless to point out the differences here.

Nolina erumpans (Torr.) S. Wats. Proc. Am. Acad. **14**: 248. 1878.

Nolina georgiana Michx. Fl. **1**: 208. 1803.

Nolina greenei S. Wats. Bot. Gaz. **5**: 56. 1880.

Nolina hartwegiana (Zucc.) Hemsley, Biol. Centr. Am. **3**: 371. 1884.

Nolina humilis S. Wats. Proc. Am. Acad. **14**: 248. 1879.

Nolina lindheimeriana (Scheele) S. Wats. Proc. Am. Acad. **14**: 247. 1879.

Nolina longifolia (Karw.) Hemsley, Biol. Centr. Am. **3**: 372. 1884.

Nolina microcarpa S. Wats. Proc. Am. Acad. **14**: 247. 1879.

Nolina nelsoni Rose, sp. nov.

Trunk 1 to 3 meters high; leaves 50 to 70 cm. long, 3 to 4 cm. broad above the base, gradually tapering to a point, both surfaces smooth, the margins serrulate; inflorescence, including the peduncle, 2 to 3.5 meters long; bracts scarious, lacerate; pedicels 5 to 6 mm. long, jointed near the middle; sepals ovate, obtuse, scarious-margined; mature fruit not seen.

Type specimen U. S. National Herbarium no. 332674, collected by E. W. Nelson near Miquihuana, Tamaulipas, June 10, 1898 (no. 4489).

In its leaves this species resembles *N. parryi* and *N. bigelovii* of the Far West, but it is certainly quite distinct.

Nolina palmeri S. Wats. Proc. Am. Acad. **14**: 248. 1879.

Nolina parryi S. Wats. Proc. Am. Acad. **14**: 247. 1879.

Nolina parviflora (H. B. K.) Hemsley, Biol. Centr. Am. **3**: 372. 1884.

Nolina pumila Rose, sp. nov.

Acaulescent; leaves numerous, in some specimens erect, in others recurved, 20 to 30 cm. long, linear, many-nerved (sometimes 15 to 20-nerved), the apex entire but in most cases broken off, the margin serrulate; inflorescence a narrow panicle, 20 to 30 cm. long, the peduncle and lower branches leafy-bracted; male flowers not seen; peduncles slender, 6 to 7 mm. long, jointed just above the base, somewhat enlarged upward; sepals papery, oblong, obtuse, 3 mm. long; fruit dry, strongly 3-lobed, indehiscent but the walls early falling away, leaving the naked seed; style short but distinct; cells 3; ovules 6; mature seeds 3, one in each cell, globular.

Type specimen U. S. National Herbarium no. 301074.

Collected by J. N. Rose near Santa Teresa, Tepec, August 10, 1897 (no. 2165); and also in southern Durango, August 16, 1897 (no. 2340).

Nolina texana S. Wats. Proc. Am. Acad. **14**: 248. 1879.

Nolina watsoni (Baker) Hemsley, Biol. Centr. Am. **3**: 372. 1884.

A NEW ECHEANDIA.

Echeandia paniculata Rose, sp. nov.

Caulescent, about 70 cm. long, leafy below, glabrous, glaucous, the basal leaves several; lower stem leaves weak, 40 to 60 cm. long, 3 to 4 cm. broad, thin, a little glaucous, with a very narrow scarious margin only slightly serrulate; inflorescence 6-branched, the branches 20 to 30 cm. long, the bracts scarious, each subtending 3 (rarely 2) flowers; perianth 6-parted, yellow, the three outer lobes linear-oblong, the others oblong, 14 mm. long, 6 to 7 mm. broad, all reflexed in full flower but erect and twisted in age; filament free, with thin scales; anthers united.

Collected by J. N. Rose and Jos. H. Painter on bluff at Tepoxtlan, Morelos, September 2, 1903 (no. 844), and flowered in Washington, November, 1904.

This species is nearest *E. reflexa*, but is more leafy and has a more branched inflorescence.

The following species also belongs to Echeandia but has never been placed in that genus:

Echeandia reflexa (Cav.) Rose.

Anthericum reflexum Cav. Ic. Pl. 3: 21. *pl. 241.* 1794.

NYMPHAEACEAE.

THE MEXICAN WATERLILIES.

For several years past I have been greatly interested in the Mexican Castalias, having myself collected four of the seven species, one of which has long borne an unpublished name. When I learned some years ago that Dr. Henry Conard was preparing a monograph of the genus Nymphaea I withheld my notes from publication and turned over the specimens to Doctor Conard for his inspection. His monograph, an exhaustive treatise and beautifully illustrated, has recently appeared.

I have attempted here only to present a very brief synopsis of our Mexican species, referring the reader to Doctor Conard's work for a full treatment of them.

KEY TO THE MEXICAN SPECIES OF CASTALIA.

- Flowers yellow.
  - Flowers 6 to 9 cm. wide; inner petals rounded at tip .... 1. *C. flava.*
  - Flowers 11 to 15 cm. wide; inner petals pointed................ 2. *C. mexicana.*
- Flowers not yellow.
  - Flowers blue.. 3. *C. elegans.*
  - Flowers white.
    - Stamens with slender terminal appendages .... 4. *C. gracilis.*
    - Stamens with short or no terminal appendages.
      - Leaves strongly nerved beneath; margin toothed...... 5. *C. ampla.*
      - Leaves not strongly nerved below; margin entire or nearly so.
        - Sinus closed; leaves retuse at apex .... 6. *C. pringlei.*
        - Sinus open; leaves rounded at apex .... 7. *C. odorata.*

Castalia flava (Leitner) Greene, Bull. Torr. Club **15**: 85. 1888.

Nymphaea flava Leitner in Audubon, Birds Am. **4**: 411. 1838.

This species, I believe, has not been reported from Mexico, but its occurrence at Brownsville, Texas, would indicate that it might be expected on the Mexican side of the lower Rio Grande.

Castalia mexicana (Zucc.) Coulter, Contr. Nat. Herb. **2**: 12. 1891, as to synonym, not as to specimens.

Nymphaea mexicana Zucc. Abh. Akad. Muench. **1**: 265. 1832.

This species is very common in the lakes and along the canals in the Valley of Mexico. It has also been reported from Patzcuaro and Jalisco, but I have seen no specimens from these two localities. This Mexican species has often been confused with the *C. flava* of Florida, but it grows at much higher altitudes, has much larger flowers and very different petals, and the leaves are perhaps thicker.

Castalia mexicana has been collected only a few times and I believe has never been in cultivation.

Specimens examined:

Valley of Mexico: Bourgeau, 1865–66 (no. 4); Rose and Hough, May 26, 1899 (no. 4327).

Type locality: In lacu prope urbem Mexico.

Zuccarini described the flowers as white and this has raised the question as to the identity of our yellow-flowered Mexican species. Doctor Conard has examined the leaves of three types at Munich and pronounces them identical with the above. Either the flowers had faded out or else two species were confused in the original description. A white-flowered species grows in the Valley of Mexico along with this yellow-flowered one.

Castalia elegans (Hook.) Greene, Bull. Torr. Club **15**: 85. 1888.

Nymphaea elegans Hook. Bot. Mag. **77**: *pl. 4604*. 1851.

This species seems to be confined to the lowlands of Mexico. On the west coast of Mexico it has been collected at Topolobampo (Palmer); Mazatlan (Brandegee); and near Rosario (Rose), the latter being the southernmost station for the species. It has also been reported along the Rio Grande basin from El Paso to Brownsville. The reference of this species to Guatemala by Conard must be a mistake. According to Dr. E. Palmer the small black tubers are used by the Mexicans on the west coast as a substitute for potatoes.

Castalia gracilis (Zucc.) Rose.

Nymphaea gracilis Zucc. Abh. Akad. Muench. **1**: 362. 1832.

Mr. Conard's reference of *N. gracilis* to *N. ampla* does not seem borne out by a careful study of the original description of *N. gracilis* or by an examination of material which seems to belong to that species.

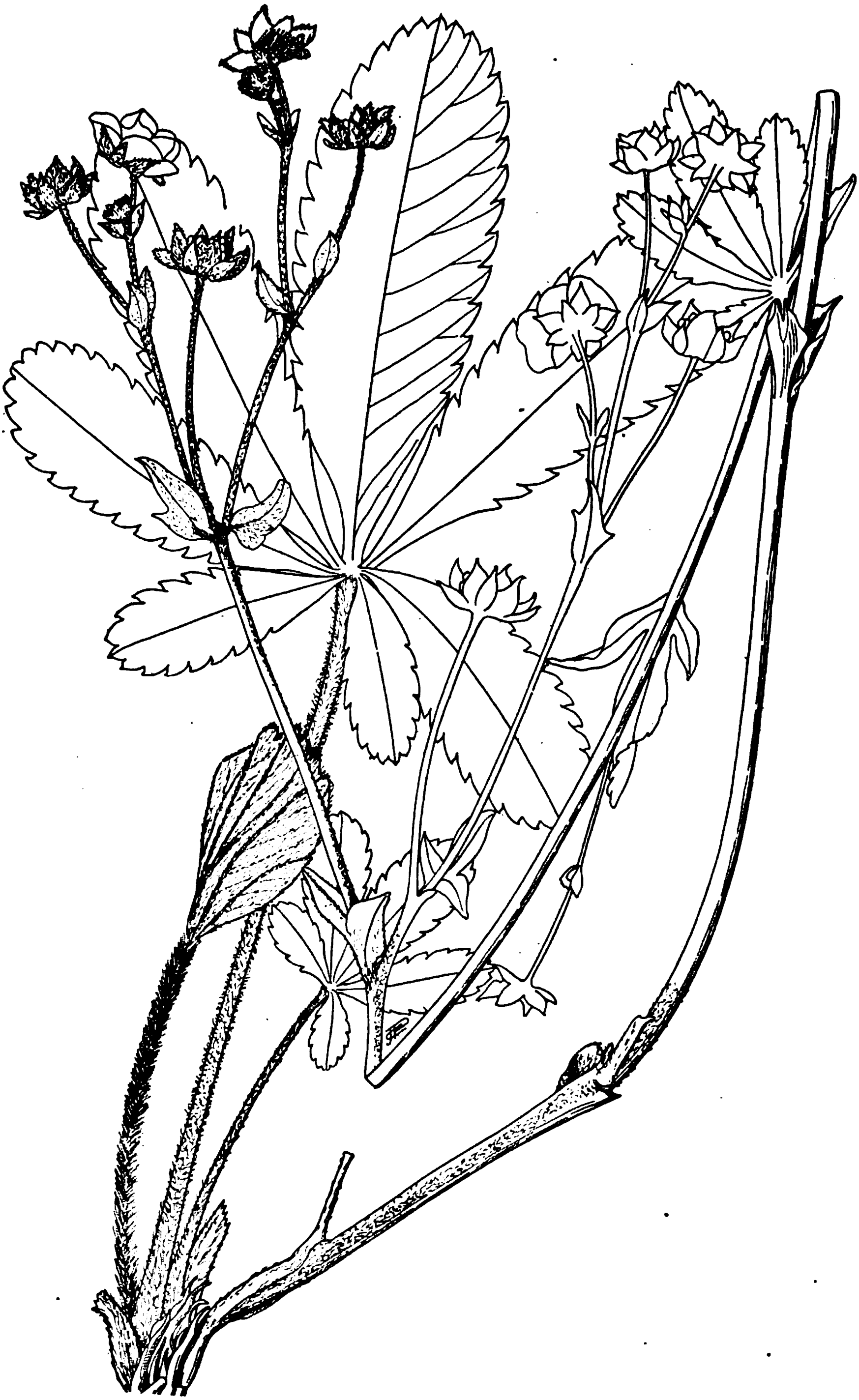
This species is common in the Valley of Mexico and throughout the Valley of Lema.

Castalia ampla Salisb. Parad. **1**: under *pl. 14*. 1805.

Castalia pringlei Rose, sp. nov.

Rhizomes apparently horizontal, large, 30 to 60 cm. long; leaves orbicular, 25 to 30 cm. in diameter, entire, retuse at apex, not at all peltate, the sinus generally closed or the lobes overlapping except the short acute tips, glabrous throughout, somewhat purplish beneath, the veins not prominent; flowers very large, 12 to 15 cm. in diameter, white; sepals 5, thin, oblong, obtuse, green except the more or less whitish margins; petals pure white, oblong, obtuse; stamens yellow, the outer ones with broad petaloid filaments, the inner with shorter and narrower filaments; connective scarcely longer than the anther.

This species is perhaps near *C. odorata*, but differs in having the flowers and leaves larger, the under surface of the leaves only slightly purplish, the sepals thinner, etc.



POTENTILLA LOZANI ROSE.

Type U. S. National Herbarium no. 461981, collected by Dr. C. G. Pringle in Lake Xochimilco, Valley of Mexico, 1896 (no. 6464); also in the same lake by J. N. Rose and Walter Hough, May 26, 1899 (no. 4330).

Doctor Conard refers this species to *Nymphaea odorata gigantea*, the "types" of which, he states, came from Saint Georges, Delaware. Even if Doctor Conard's reference were correct the name would be untenable, as there is already a *Nymphaea gigantea*.

Castalia odorata (Ait.) Woodville & Wood, Rees' Cyclopedia **6:** no. 1. 1806.

Nymphaea odorata Ait. Hort. Kew. **2:** 227. 1789.

To *C. odorata* I have referred with some doubt material collected by Dr. E. Palmer near Durango in 1896 (no. 244). This station, however, is so far away from the known range of *C. odorata*, that species having not heretofore been reported from anywhere in Mexico, that its inclusion in the Mexican flora can at present be only tentative. The possibility of the species having been introduced into ponds has been suggested, but Dr. Palmer assures me that the plant shows every indication of being a native.

RANUNCULACEAE.

TWO NEW SPECIES OF CLEMATIS.

Clematis rhodocarpa Rose, sp. nov.

Apparently high-climbing vines, somewhat pubescent; upper leaves ternate; leaflets ovate to broadly ovate, 5 to 8 cm. long, 3 to 6 cm. broad, more or less deeply cordate, coarsely toothed, acuminate, slightly pubescent on both surfaces; inflorescence usually much shorter than the leaves; sepals oblong, obtuse; fruit rose-red, only slightly hairy, when mature terminated by long curved hairy tails.

Type U. S. National Herbarium no. 253028 (Pringle's no. 4770).

Apparently common about Oaxaca, where it has been been collected by Pringle, Nelson, and Charles L. Smith.

Clematis rufa Rose, sp. nov.

A vine 3 to 9 meters long, the stem as well as the leaves densely covered with a reddish yellow pubescence; only the upper leaves seen, these ternate; leaflets lanceolate to ovate, 4 to 7 cm. long, acute to shortly acuminate, 3 to 5-nerved, entire; inflorescence compact about the length of the subtending leaf; flowers numerous; pedicels 10 to 15 mm. long; sepals oblong, obtuse; fruit not seen.

Type U. S. National Herbarium no. 234391, collected by E. W. Nelson along road between Tenejapa and Yatalon, Chiapas, altitude 400 to 1,500 meters, October 13, 1895 (no. 3243).

ROSACEAE.

A NEW POTENTILLA.

Potentilla lozani Rose & Painter. PLATE XXVI.

Perennial from a stout rootstock; stems several, erect or ascending, up to 40 cm. long, pubescent with soft scattered hairs throughout, most plentifully so at base; leaves 5-foliolate, strictly palmate, on long silky-pubescent petioles; leaflets of basal leaves with scattered short hairs above and more copious hairs beneath, rounded at apex, crenately toothed, 20 to 40 cm. long, obovate to oblong, cuneate; stipules ovate, entire; flowering stems bearing few small leaves; calyx lobes ovate, acute, hairy; petals dark purple, emarginate, almost rhombic in outline, slightly exceeding the sepals.

Type U. S. National Herbarium no. 461978, collected by C. G. Pringle and F. Lozano in meadows at Cuyamoloya, Hidalgo, August 2, 1904 (no. 1345), and by Rose and Painter between Somoriel and Las Lajas, Hidalgo, August 5, 1905 (no. 9234).

EXPLANATION OF PLATE XXVI.—Plant, natural size.

TWO NEW SPECIES OF ALCHEMILLA.

In preparing a synopsis of the Mexican species of Alchemilla I find the two following species undescribed. The genus Alchemilla is a very difficult one, owing to the fact that the flowers are all extremely small and not easy to make out clearly with an ordinary hand lens, whence collectors and botanists have not looked into the floral characters carefully. As a result several Mexican species are passing under the same name.

Alchemilla procumbens Rose, sp. nov. PLATE XXVII.

Perennial with numerous creeping stems, these clothed with appressed pubescence; leaves 3-parted, appearing 5-parted from the lateral lobes being deeply cleft, dark green and glabrous above, paler and appressed-pubescent beneath, the lobes spatulate, rounded at apex, serrate-toothed; stipules united at base, toothed; inflorescence rather open, few-flowered; pedicels slender, 4 to 8 mm. long, silky-pubescent; calyx pubescent, 8-parted, the 4 outer lobes much broader and longer than the others, pubescent within; stamens 2; styles sometimes as many as 8.

Type U. S. National Herbarium no. 452685, collected by J. N. Rose and Jos. H. Painter between Somoriel and Las Lajas, Hidalgo, August 5, 1905 (no. 9202).

Apparently common in the high mountains of Mexico from Zacatecas to Oaxaca.

EXPLANATION OF PLATE XXVII.—Fig. *a*, plant; *b*, calyx; *c*, section of calyx showing stamens and styles. Fig. *a*, natural size; figs. *b* and *c*, enlarged.

Alchemilla subalpestris Rose, sp. nov.

Perennial but with herbaceous stems, either single and erect or much branched at base and ascending; stems 10 to 30 cm. long, often glabrous throughout or with scattered hairs on the stem, leaves, and bracts and very rarely on the calyx; basal and lower stem leaves on petioles sometimes 6 to 9 cm. long, somewhat orbicular in outline, more or less lobed and cleft; upper stem leaves perfoliate, the lobes 3 or 4-cleft into linear obtuse teeth, the margins revolute; flowers subsessile; calyx usually glabrous, 8-lobed, the lobes nearly equal; stamens 2; styles 2; fruiting calyx 1 mm. long; seeds ovoid in outline, pointed.

Type U. S. National Herbarium no. 451546 (Rose no. 7928 from Nevada de Toluca).

Apparently common in the high mountains throughout Mexico. I have frequently collected it, first in the Sierra Madre of Tepic, afterwards on Mount Orizaba and Mount Toluca, and several times on the high mountains surrounding the valley of Mexico.

This species is probably *A. hirsuta alpestris* Schlecht. & Cham.; at least it is the plant so understood by Dr. S. Watson and Mr. Hemsley. But I have not seen the type and with only the short original diagnosis I can not be sure of this, while in any case the name *alpestris* is a homonym and must be rejected.

MIMOSACEAE.

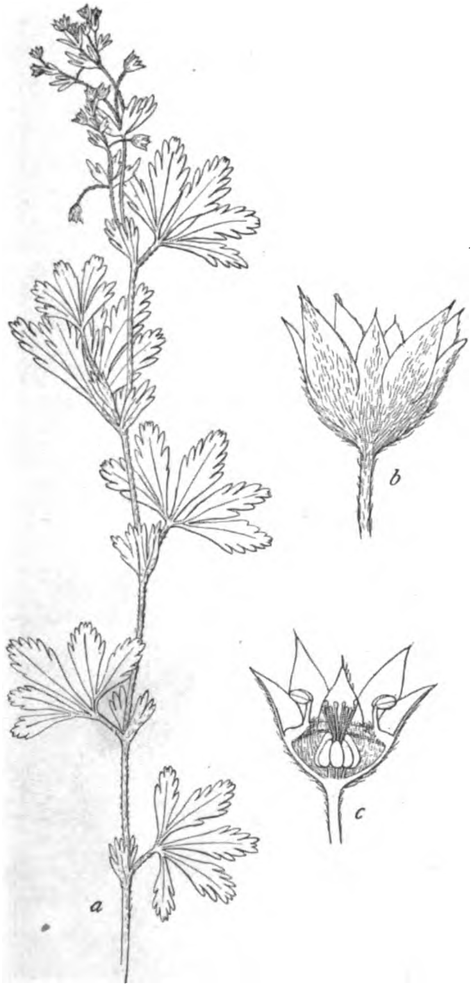
A NEW PITHECOLOBIUM.

Pithecolobium revolutum Rose, sp. nov. PLATE XXVIII.

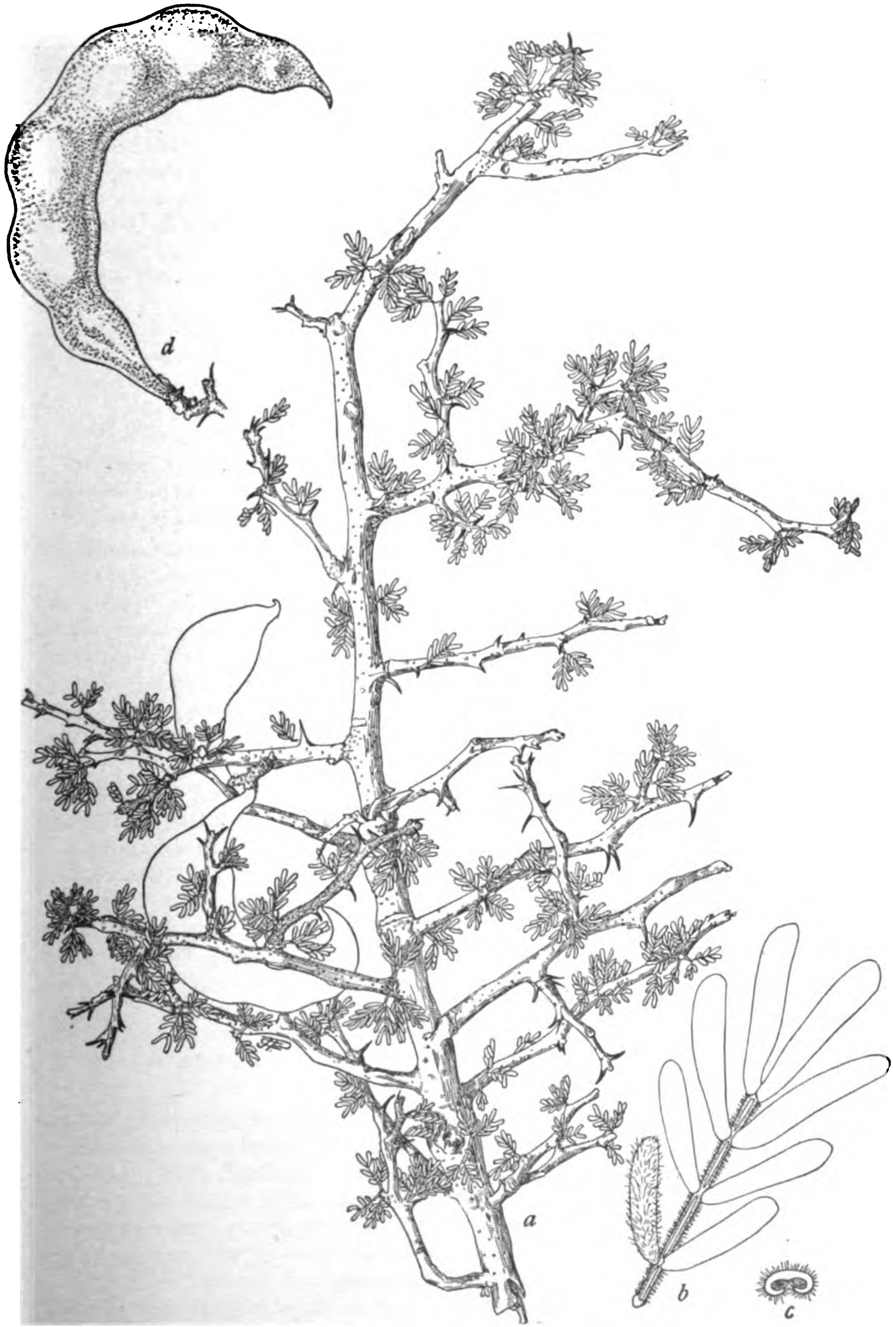
A low depressed compact bush; first year branches very pubescent, older branches gray and glabrous; stipular spines short, stout, straight or becoming recurved; pinnae one pair; common petiole short, bearing a gland at the top; leaflets 3 to 5 pairs, closely set, linear, obtuse, the margins strongly involute, covered with short stiff hairs as are also the rachis and petioles; flowers not seen; pods curved, flattened, 5 to 7 cm. long, 10 to 12 mm. broad, pubescent; seeds black.

Type U. S. National Herbarium no. 453274, collected by Rose and Painter south of Higuerillas, Querétaro, August 23, 1905 (no. 9784). Here a common desert shrub.

EXPLANATION OF PLATE XXVIII.—Fig. *a*, branch; *b*, leaf; *c*, cross section of leaflet; *d*, fruit. Figs. *a* and *d*, natural size; *b* and *c*, scale 6.



ALCHEMILLA PROCUMBENS ROSE.



PITHECOLOBIUM REVOLUTUM ROSE.

CAESALPINIACEAE.

THREE NEW BAUHINIAS.

Bauhinia confusa Rose, sp. nov.

Shrub about 2 meters high; pubescence on young branches short and dense; leaves 5 to 6 cm. long, either rounded at base or with a broad sinus, the terminal lobes about one-third the length of the blade, slightly spreading, acute, slightly hairy above, pubescent on the veins beneath; petiole shorter than the blade, pubescent; inflorescence a dense raceme becoming 4 to 5 cm. long; bracts long-acuminate; buds elongated, with long free tips; calyx spathaceous; corolla white, 15 mm. long, tapering at base into a slender claw, long-acuminate; perfect stamens one, glabrous; ovary on a long slender stipe, pubescent; pods 10 to 12 cm. long, 10 to 12 mm. broad, flat, glabrate.

Type U. S. National Herbarium no. 461982 (Pringle's no. 3104).

Specimens examined:

San Luis Potosi: Tamasopa Cañon, C. G. Pringle, June 25, 1890 (no. 3104); San Dieguito, Dr. E. Palmer, June, 1904 (no. 126); near Tancanhuitz, E. W. Nelson, May, 1898 (no. 4363).

Dr. Pringle's specimens were distributed as *B. divaricata* L., a species with very different leaves.

The above description of the pods is drawn from Mr. Nelson's specimen.

Bauhinia goldmani Rose, sp. nov.

A small tree 6 to 8 meters high; young branches pubescent; petioles 6 to 10 mm. long; leaves slightly cordate at base, 5 to 7 cm. long, the lobes one-third the length of the blade, ovate, ascending and obtuse, glabrate above, softly pubescent beneath, reticulate; racemes short and compact; peduncles 15 to 18 mm. long; calyx tips free, filiform; petals narrow, glabrous, about 25 mm. long, purple; perfect stamen 1; ovary long-stipitate, pubescent; pods 10 to 12 cm. long, 12 mm. broad, long-apiculate, on a stipe 10 to 18 mm. long.

Type U. S. National Herbarium no. 470546, collected by E. A. Goldman at Tuxtla Gutierrez, Chiapas, March 8, 1904 (no. 742).

Bauhinia (Pauletia) **longiflora** Rose, sp. nov.

A bush 3 meters high, with pubescent branches; leaves orbicular, 25 to 50 mm. long, broadly cordate at base, lobed at apex, glabrous above, pale and pubescent beneath, 7 to 9-nerved; lobes rounded; petioles shorter than the leaves; stipules spinescent, unequal; flowers axillary in twos, or in terminal racemes, slender, 7.5 to 10 cm. long, greenish-yellow; calyx spathaceous; petals 5, filiform; stamens 10, 5 anther-bearing; ovaries villous; pods 15 to 20 cm. long, 12 mm. broad.

Type U. S. National Herbarium no. 305328, collected by Dr. E. Palmer, ravines and mountain sides, Ymala, Sinaloa, August 16 to 25, 1891 (no. 1426); in fruit, October 17 (letter *D*).

FOUR NEW CASSIAS.

Cassia arida Rose, sp. nov.

Perennial, much branched at base, erect, 15 cm. high, pubescent; stipules linear, pubescent, often glandular; petioles slender, 3 to 4 cm. long, bearing a slender gland between the leaflets of the lowest pair; leaflets 3 pairs, oblong, 15 to 22 mm. long, tipped by a brown perhaps deciduous mucro; peduncles 6 to 9 cm. long; pods 3 to 4 cm. long, somewhat incurved, acuminate, hairy.

Type U. S. National Herbarium no. 453267, collected by J. N. Rose and Jos. H. Painter, near Higuerillas, Querétaro, August 23, 1905 (no. 9778). A common plant of the deserts in that locality.

Cassia demissa Rose, sp. nov.

Stems low, often trailing, much branched, pubescent; petioles slender, 15 to 30 mm. long; leaflets generally two pairs, rarely three pairs, oblong, 10 to 15 mm. long, mucronate, slightly pubescent above, appressed-pubescent beneath; peduncles about as long as the leaves, 2 or 3-flowered; pods very short, 10 to 12 mm. long, mucronate.

Type U. S. National Herbarium no. 280167, collected by C. G. Pringle near Carneros Pass, Coahuila, 1889 (no. 2783); also by Dr. E. Palmer in the Sierra Madre south of Saltillo, 1880 (no. 281).

This species has been confused with *C. vogeliana*, but it has the pods much shorter, the leaflets fewer, etc.

Cassia durangensis Rose, sp. nov.

Stems apparently single and erect, 20 to 40 cm. high, velvety pubescent; leaflets 1 pair, broadly oblong to nearly orbicular, 3 to 5 cm. long, with dense soft pubescence on both sides of a decidedly yellowish cast, especially when young; peduncles longer than the leaves, usually 3 to 5-flowered; pods strict, 3 to 3.5 cm. long; seeds glossy.

Type U. S. National Herbarium no. 304717, collected by Dr. E. Palmer near Durango in 1896 (no. 271); also near the same place by E. W. Nelson in 1898 (no. 4595).

Perhaps nearest *C. bauhinioides* Gray, but of simple and more erect habit with larger and much broader leaflets, more upright pods, etc.

Cassia goldmani Rose, sp. nov.

Shrub or tree 4 to 6 meters high; leaves clustered near the ends of stunted branches or scattered along the vigorous branches; rachis slightly pubescent; leaflets 5 to 12 pairs, rather thick, the venation somewhat indistinct, glabrous or nearly so, the margins never ciliate, pale on both sides, perhaps glaucous, 12 to 16 mm. long, broadest near the tip, oblique at base, rounded at apex, usually with a short mucro; pods 8 to 10 cm. long, somewhat glaucous, 2 cm. or more broad, the margins winged.

Type U. S. National Herbarium no. 565323, collected by Nelson and Goldman about 5 miles southwest of El Potrero, Lower California, October 31, 1905 (no. 7238).

Resembling *C. polyantha* of Central Mexico, but having somewhat different leaflets, less pubescence on branches and leaflets, etc.

HOFFMANSEGGIA: A NEW SPECIES AND A NEW NAME.

Hoffmanseggia arida Rose, sp. nov. PLATE XXIX.

Stems low, diffuse, usually herbaceous but sometimes woody at base, glabrous except some stipitate glands; stipules ovate, acute; petioles slender, bearing a few stipitate glands; pinnae 3 to 6 pairs; leaflets 4 to 8 pairs, oblong, 3 to 4 mm. long, glabrous except a gland in the retuse apex; inflorescence an erect or ascending raceme, 10 to 20 cm. long including the peduncle, at first very dense, bearing many stipitate glands; bracts subtending the flowers ovate, acuminate, ciliate; calyx deeply 5-parted, the lobes somewhat unequal, ciliate; flowers yellow tinged with red; pods narrowly oblong, 3 to 4 cm. long, acute, glabrous except for the numerous stipitate glands.

Common on the deserts of Querétaro.

Type U. S. National Herbarium no. 453109, collected by J. N. Rose and Jos. H. Painter between San Juan del Rio and Cadereyta, August 19, 1905 (no. 9619); also near Higuerillas, August 23, 1903 (no. 9770).

This species is near *H. stricta* Benth., but the inflorescence and pods lack the soft pubescence on the racemes and pods.

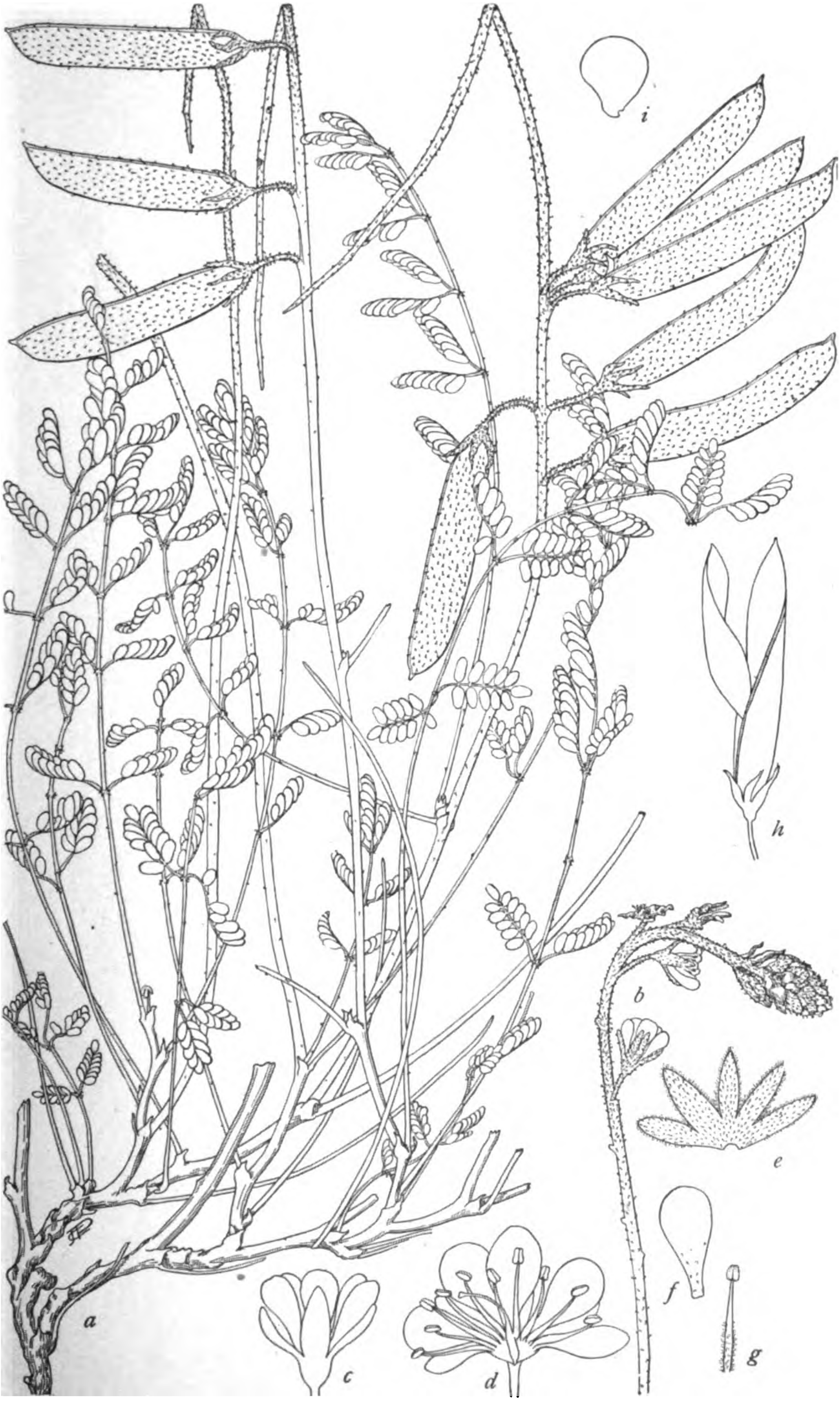
EXPLANATION OF PLATE XXIX.—Fig. *a*, flower; *b*, inflorescence; *c*, flower; *d*, corolla laid open; *e*, calyx laid open; *f*, petal; *g*, stamen; *h*, fruit; *i*, seed. Figs. *a*, *b*, and *h*, natural size; *c*, *d*, *e*, *f*, *g*, and *i*, scale 2.

Hoffmanseggia watsoni (Fisher) Rose.

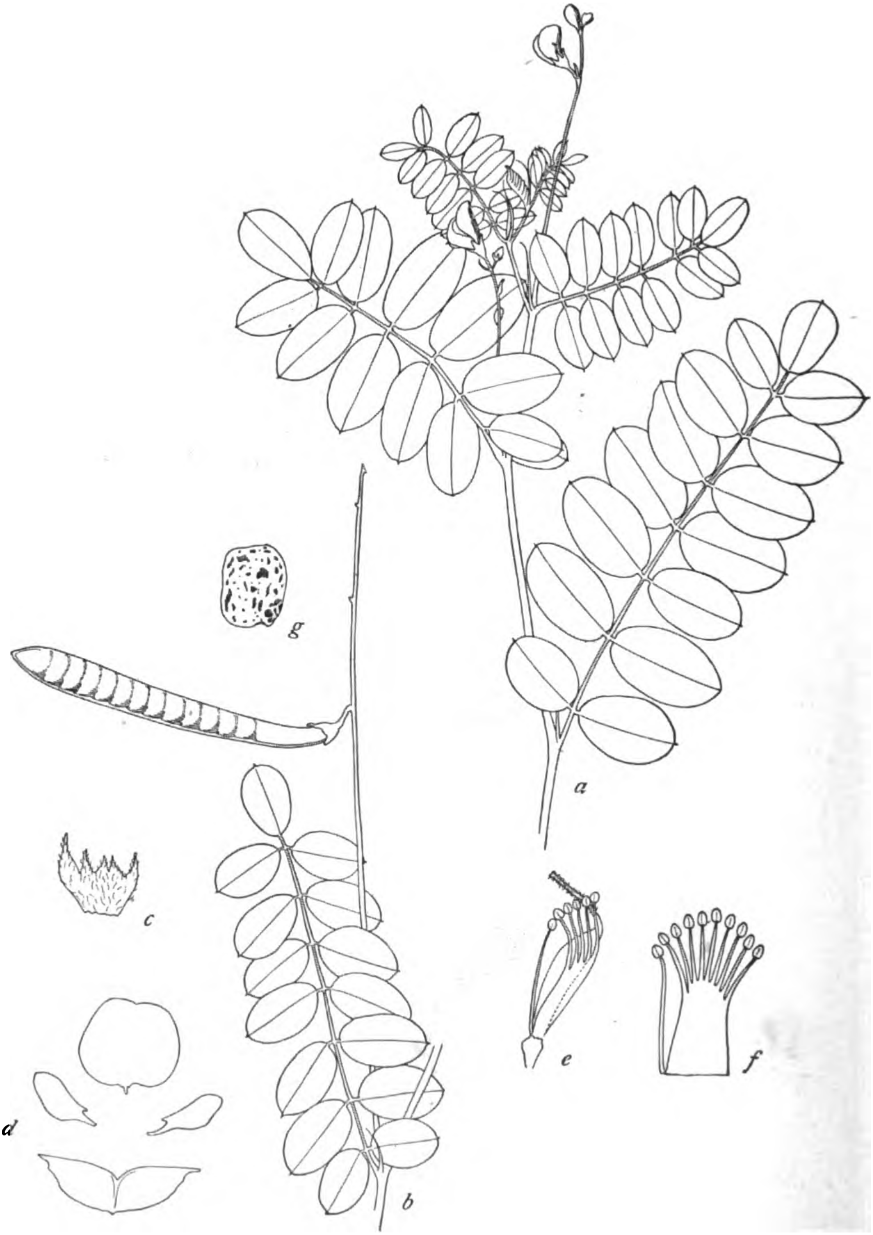
H. gracilis S. Wats. Proc. Am. Acad. **17**: 347. 1882, not Hook. & Arn. 1833.

Caesalpinia watsoni Fisher, Bot. Gaz. **18**: 122. 1893.

PLATE XXIX.



HOFFMANSEGGIA ARIDA ROSE.



BENTHAMANTHA PUMILA ROSE.

VICIACEAE.

THE MEXICAN AND CENTRAL AMERICAN SPECIES OF BENTHAMANTHA.

The name Cracca of Bentham being a homonym, the genus was renamed Brittonamra by Otto Kuntze, but he afterwards took up the older name Benthamantha published by Alefeld in 1862. This latter course has been followed by Britten and Baker who published in the Journal of Botany for January, 1900, a list of all the known species. I wish to make a few slight changes in this list, adding also two new species.

Benthamantha edwardsii (A. Gray) Rose.
Benthamantha grayi Alefeld, Bonplandia **10:** 264. 1862.
Cracca edwardsii A. Gray, Pl. Wright. **2:** 35. 1853.
Gray's variety *glabella* is certainly not a form of *B. edwardsii*, but is much closer to *B. sericea.*

Benthamantha greenmanii (Millspaugh) Rose. [illegible]
Cracca greenmanii Millsp. Field Columb. Mus. Bot. **1:** 299. *pl. 13.* 1896. [illegible]

Benthamantha bicolor (Micheli) Rose.
Cracca bicolor Micheli, Bull. Herb. Boiss. **2:** 444. *pl. 11.* 1894.
Native of Guatemala.

Benthamantha micrantha (Micheli) Rose.
Cracca micrantha Micheli, Prim. Fl. Costaric. **1:** 189. 1891.
Native of Guatemala.

Benthamantha fruticosa Rose, sp. nov.

Stem perhaps nearly a meter high, shrubby, the bark of the branches silky-pubescent the first year, white the second year; leaves pinnate; leaflets 3 to 5 pairs, silky-pubescent, oblong, 8 to 12 mm. long, rounded at apex, mucronate; racemes few-flowered, either shorter or longer than the leaves; bracts subtending the flowers filiform, longer than the pedicels; calyx lobes linear, silky-pubescent; petals greenish yellow or the banner more or less purplish; pods linear, pubescent, 4 to 6 mm. long, many-seeded.

Type U. S. National Herbarium no. 453587, collected by Rose and Painter in Tomellín Cañon, Oaxaca, September, 1905 (no. 10087); also at the same locality by Rose and Hough, June 23, 1899 (no. 4665).

Benthamantha glandulosa Rose, sp. nov.

Branches herbaceous, spreading, pubescent; leaflets 5 to 7, oblong to obovate, pubescent on both surfaces, paler beneath, rounded at apex, mucronate; stipules linear; racemes much longer than the leaves, the rachis as well as the calyx bearing silky and glandular hairs; ovary not at all pilose; style hairy.

Type U. S. National Herbarium no. 258413 (Smith's no. 3301).

Collected by Heyde and Lux in Guatemala, Department of Santa Rosa, at Chiapas, September, 1892, and Casillas, May, 1892. Both specimens were named *Cracca mollis* by Micheli and distributed by Capt. John Donnell Smith under the numbers 3745 and 3301 respectively. The species is very different from the South American species, *B. mollis.*

Benthamantha pumila Rose, sp. nov. PLATE XXX.

Low, more or less spreading, herbaceous, purplish, pubescent; leaflets 11 to 15, oblong, glabrous above even from the first, more or less appressed-pubescent beneath; common petiole short; stipules linear, elongated; fruiting raceme nearly twice as long as the leaves; pods glaucous, 4 to 5 cm. long, 4 to 5 mm. broad; seeds yellow mottled with brown.

Type U. S. National Herbarium no. 453173, collected by Rose and Painter on the road between San Juan del Rio and Cadereyta, Querétaro, August, 1905 (no. 9683).

Explanation of Plate XXX.—Fig. *a*, flowering branch; *b*, fruiting branch; *c*, calyx; *d*, petals; *e* and *f*, stamens; *g*, seed. Figs. *a* and *b*, natural size; *c* and *d*, scale 2; *e*, *f*, and *g*, scale 4.

TWO ADDITIONAL SPECIES OF COLOGANIA.

In 1904 I published a synopsis of the species of Cologania and the next year the description of *C. congesta.* In 1903 and 1905 I collected many additional specimens (47 sheets) in Mexico, which have greatly enriched our herbaria and added much to our knowledge of the genus.

Cologania lozani Rose, sp. nov.

Stems twining with spreading or somewhat reflexed reddish hairs; leaflets 3, lanceolate or somewhat rhombic, 4 to 7 cm. long, 1.5 to 2.5 cm. broad, acute, roughish-pubescent on both sides, dark green above, flowers (so far as known) in umbels of four; peduncle 2 to 4 mm. long; pedicels about 10 mm. long, hairy; bractlets at base of calyx 2, filiform; calyx 8 mm. long, somewhat purplish, glabrous except for a few spreading hairs; lower calyx lobe linear, longer than the others; corolla purplish, 25 mm. long; fruit not seen.

Type U. S. National Herbarium no. 461966, collected by C. G. Pringle and his most valuable assistant, Filemón Lozano, in the Sierra Madre near Monterey, Nuevo Leon, September 7, 1904 (no. 13425).

This species is near *C. deamii*, but has very differently shaped leaflets, etc.

Cologania tenuis Rose, sp. nov. Plate XXXI.

A delicate twining vine with appressed pubescence; leaflets 3, very thin, ovate-oblong, 3.5 to 6 cm. broad, rounded at base, acute, with scanty appressed pubescence on both sides, pale beneath; flowers 4 or 5 in a subsessile umbel or short raceme; peduncles 5 to 10 mm. long; calyx tube 8 mm. long, purple, densely pilose; upper calyx lobe entire, acute; the lower one linear, much longer than the others; corolla purple, 2.5 cm. long; pods narrow, 4 cm. or more long, appressed-pubescent.

Type U. S. National Herbarium no. 450806 (Rose no. 7223). Collected by Dr. C. G. Pringle in a mountain canyon above Cuernavaca, Morelos, July 21, 1904 (no. 13414), in the same general region (El Parque) by Rose and Painter, September 21, 1903 (no. 7223), and by Dr. C. A. Purpus at Salto de Agua, October, 1905 (no. 1750).

This species should probably be placed near *C. grandiflora*, but it has different foliage, smaller flowers, and different pubescence on the calyx.

Explanation of Plate XXXI.—Fig. *a*, plant, *b*, fruit; *c*, calyx; *d*, banner; *e*, wing; *f*, keel; *g*, stamens; *h*, ovary. Figs. *a* to *f*, natural size; *g* and *h*, scale 2.

THE MEXICAN SPECIES OF DOLICHOLUS.[a]

Mr. Hemsley, in the Biologia Centrali-Americana, published in 1880, credits ten species of Rhynchosia to Mexico proper.

Of these, *R. caribaea* has been excluded by S. Watson, and *R. menispermoides* has been referred by Miss Vail to *americana*. The Mexican specimens referred to *R. senna* are true *R. texana* Torr. & Gr. Several of the Mexican species have since been described, and four others

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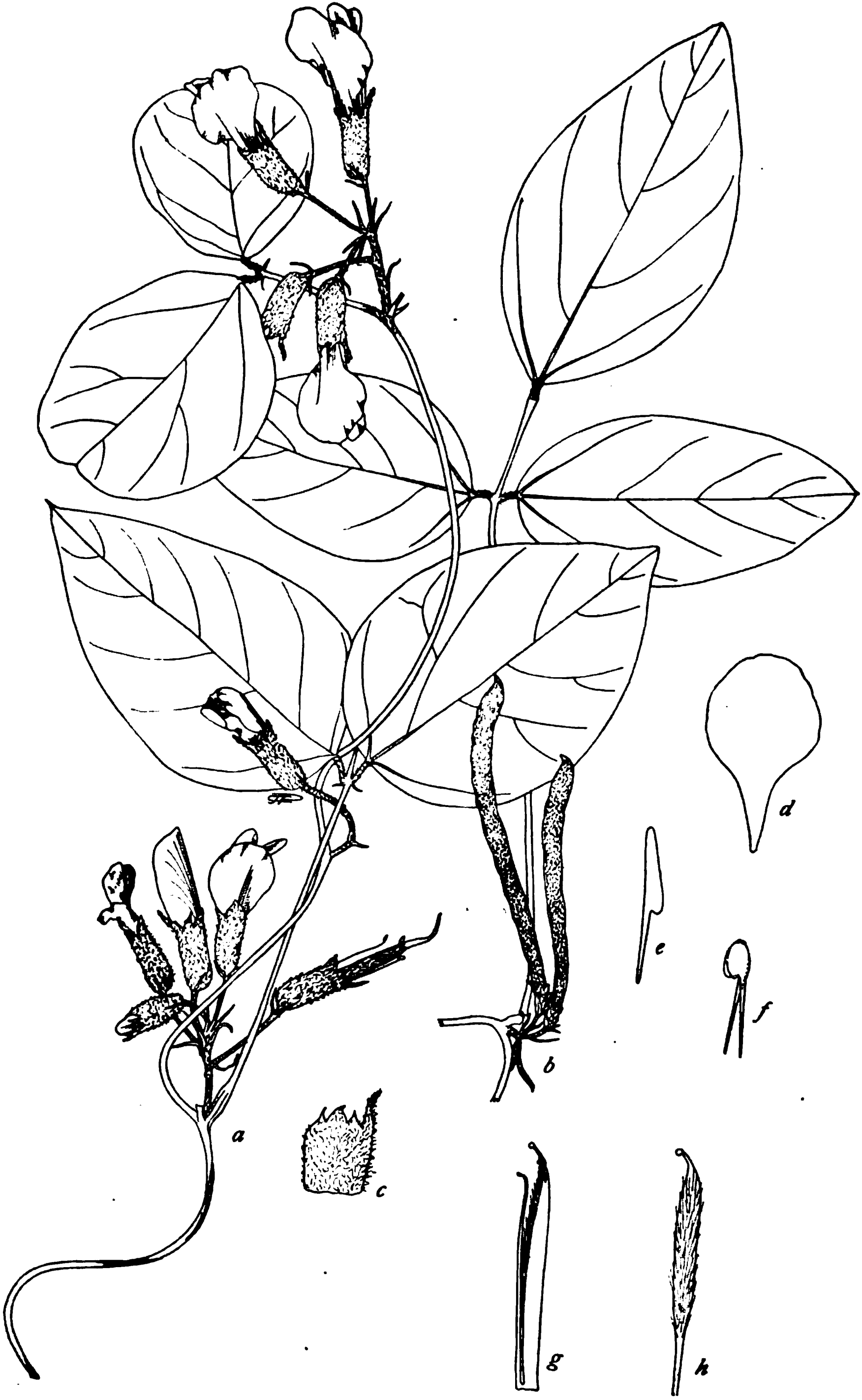
[a] Dolicholus Medic. Vorles. Churpf. Phys. Ges. 2:354. 1787.
Type species *D. minima* (L.) Medic. loc. cit.
Rhynchosia Lour. Fl. Cochinch. 2:460. 1790.
Type species *R. volubilis* Lour. loc. cit.



COLOGANIA TENUIS ROSE.

are here added. *R. phaseoloides* has been credited to Mexico by several writers, but is probably to be excluded. I have examined all the Mexican species except *R. hirsuta*, *R. erythrinoides*, and *R. bicolor*.

The name Rhynchosia, first published in 1790, must give place to the older name Dolicholus. The Mexican species with which I am familiar are the following:

Dolicholus americanus (Mill.) Vail.

Dolicholus cuernavacanus Rose.
Rhynchosia cuernavacana Rose, Contr. Nat. Herb. **8**: 313. 1905.

Dolicholus discolor (Mart. & Gal.) Rose.
Rhynchosia discolor Mart. & Gal. Bull. Acad. Brux. **10**^{2}: 198. 1843.

Dolicholus hondurensis Rose, sp. nov.

Delicate vine, pubescent; leaflets 3, obovate, 2 to 4 cm. long, acute, sometimes shortly acuminate, rounded or broadly wedge-shaped at the base, with appressed pubescence on both surfaces, strongly nerved beneath; racemes 8 to 12 cm. long, densely flowered; pedicels short (1 mm. long); pods small, 8 to 10 mm. long, apiculate.

Type U. S. National Herbarium no. 246585, collected by C. Thierne near San Pedro Sula, Department of Santa Barbara, Honduras, May, 1888, and distributed by John Donnell Smith (no. 5200).

This species was distributed as *Rhynchosia precatoria* DC., but it is much nearer *R. calycosa* Hemsley, though still quite distinct from that species.

Dolicholus longeracemosus (Mart. & Gal.) Rose.
Rhynchosia longeracemosa Mart. & Gal. Bull. Acad. Brux. **10**^{2}: 198. 1843.

Dolicholus macrocarpus (Benth.) Rose.
Rhynchosia macrocarpa Benth. Pl. Hartw. 11. 1839.

Dolicholus minimus (L.) Medic.

Dolicholus nelsoni Rose, sp. nov.

Doubtless a high-climbing vine; leaflets 3, softly pubescent on both surfaces, broadly ovate, 4 to 6 cm. long, in cultivated specimens 10 cm. long, shortly acuminate; raceme 10 to 15 cm. long; pedicels slender, 3 to 4 mm. long, covered with soft white pubescence interspersed with long yellow stiff hairs as are also the calyx and peduncle; calyx teeth 5, all narrow, the two upper united below, the lowermost one much longer than the others.

Type U. S. National Herbarium no. 273452, collected by E. W. Nelson on road between Tlaliscatillo, Guerrero, and Tlapacingo, Oaxaca, altitude 1,260 to 1,560 meters, December 6, 1894 (no. 2052).

Dolicholus nigropunctatus (S. Wats.) Rose.
Rhynchosia nigropunctata S. Wats. Proc. Am. Acad. **22**: 408. 1887.

Dolicholus precatorius (Humb. & Bonp.) Rose.
Rhynchosia precatoria DC. Prod. **2**: 385. 1825.
Glycine precatoria Humb. & Bonp. Willd. Enum. Hort. Berol. 755. 1809.

Dolicholus pringlei Rose.
Rhynchosia pringlei Rose, Contr. Nat. Herb. **3**: 316. 1895.

Dolicholus texanus (Torr. & Gr.) Vail.

Dolicholus vailiae Rose, sp. nov.

Vine climbing to the height of 2 to 3 meters; leaflets 3, softly pubescent on both surfaces, ovate, 3 to 7 cm. long, acuminate; racemes elongated, 20 to 25 cm. long, much longer than the leaves; pedicels 1 to 1.5 mm. long; calyx bearing yellow stiff hairs; sepals linear, the lower much longer; banner brown, orbicular, pubescent without; pods pubescent, 2 cm. long; mature seeds not seen.

Type U. S. National Herbarium no. 40237, collected by Dr. E. Palmer near Tequila, Jalisco, 1886 (no. 269). Also collected near the same station by C. G. Pringle, September 25, 1893 (no. 4597).

This species was distributed as *Rhynchosia phaseoloides* DC., from which it is very distinct in foliage, pods, distribution, etc. This species is named for Miss Anna Murray Vail, who [a] first called attention to the fact that Doctor Palmer's plant had been wrongly distributed.

RESTORATION OF ODONIA, WITH ITS MEXICAN SPECIES.

The genus Odonia was first described by Bertoloni in 1822 and afterwards taken up by DeCandolle in 1825 and Sprengel in 1827. Bentham and Hooker, however, combined it with Galactia, where it has since remained. It is true that many supposed species of Galactia are congeneric with Odonia and this is probably the one reason why the two genera have been combined. The true type of Galactia is the large scarlet-flowered species from Jamaica long known as *Galactia pendula* but now as *Galactia galactia*. It is very different from all our United States and Mexican species in its corolla. The Mexican species of Odonia will be as follows:

Odonia acapulcensis Rose.
Galactia acapulcensis Rose, Contr. Nat. Herb. **5**: 137. 1897.

Odonia brachystachys (Benth.) Rose.
Galactia brachystachys Benth. Ann. Wien. Mus. **2**: 127. 1837–40.

Odonia multiflora (Robinson) Rose.
Galactia multiflora Robinson, Proc. Am. Acad. **29**: 315. 1894.

Odonia wrightii (A. Gray) Rose.
Galactia wrightii A. Gray, Pl. Wright. **1**: 44. 1852.

Odonia incana Rose, sp. nov. PLATE XXXII.

A bushy plant, the branches apparently never twining, softly pubescent; leaflets 3, lanceolate, 3 to 7 cm. long, acute and bearing a long mucro, dark green and slightly pubescent above, very pale and more pubescent beneath; racemes elongated, much longer than the leaves, sometimes 20 cm. long, many-flowered; flower buds covered with a dense silvery pubescence; petals purplish, the banner nearly orbicular; ovary pubescent, many-ovuled; pods not seen.

Type U. S. National Herbarium no. 302336, collected by J. N. Rose in Tepic between Aguacata and Dolores, August 6, 1897 (no. 3360).

EXPLANATION OF PLATE XXXII.—Fig. *a*, plant; *b*, flower; *c*, calyx; *d*, banner; *e*, wing; *f*, keel; *g*, stamens; *h*, pistil; *i*, ovary. Fig. *a*, natural size; figs. *b* to *h*, scale 2; *i*, scale 4.

Odonia retusa Rose, sp. nov.

A vine, 2 to 4 meters long, hirsute; leaflets 3, oblong, 3 to 6 cm. long, retuse, somewhat pubescent above, softly and densely pubescent beneath; racemes slender, 10 to 20 cm. long, much longer than the leaves; loosely-flowered; pedicels short; calyx tube proper about 2 mm. long; calyx lobes 4, narrow, 4 cm. long; corolla pale blue, about 8 mm. long; banner orbicular, retuse; fruit 6 to 8 cm. long, 5 mm. broad, pubescent, flattened.

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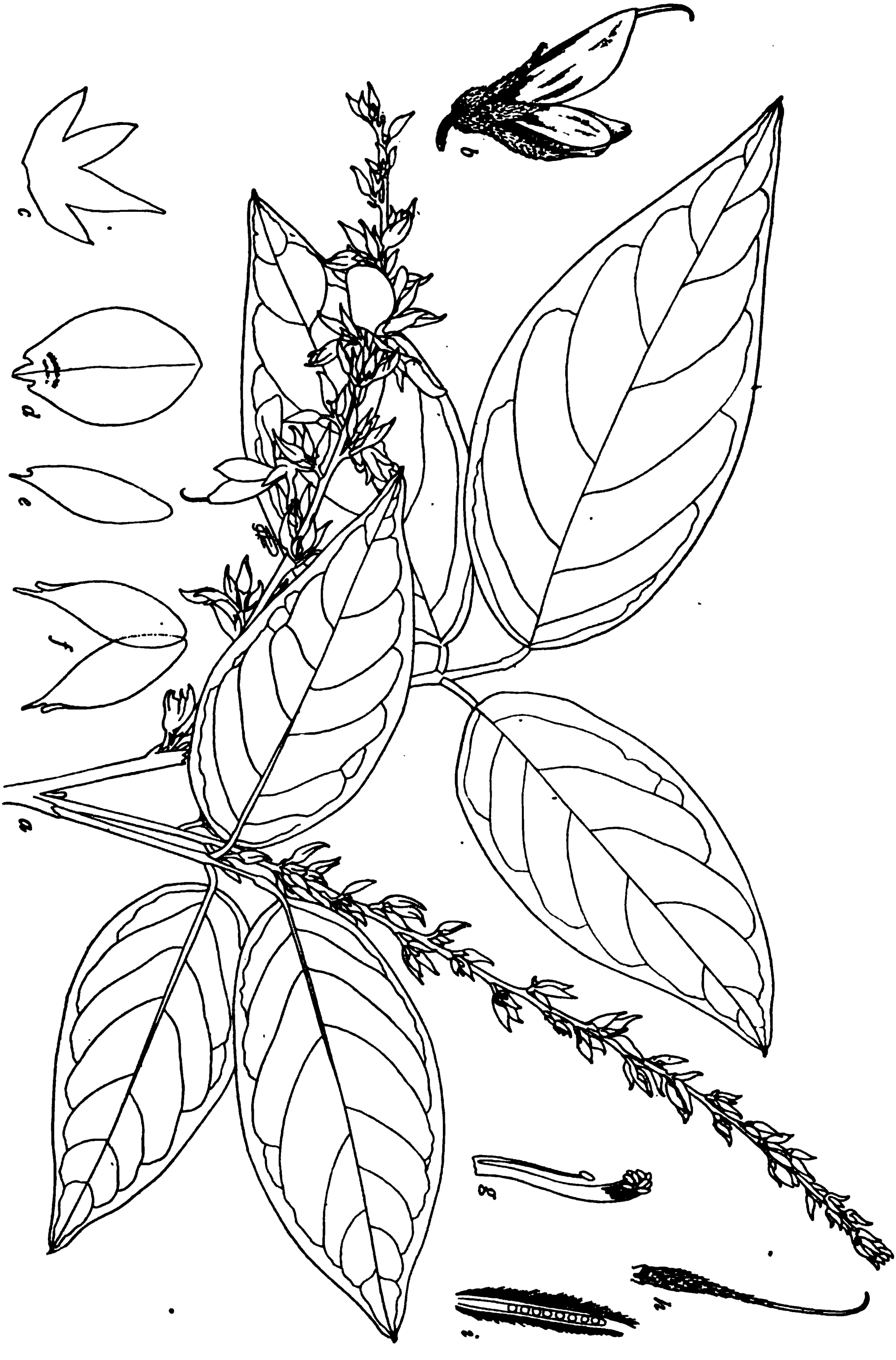
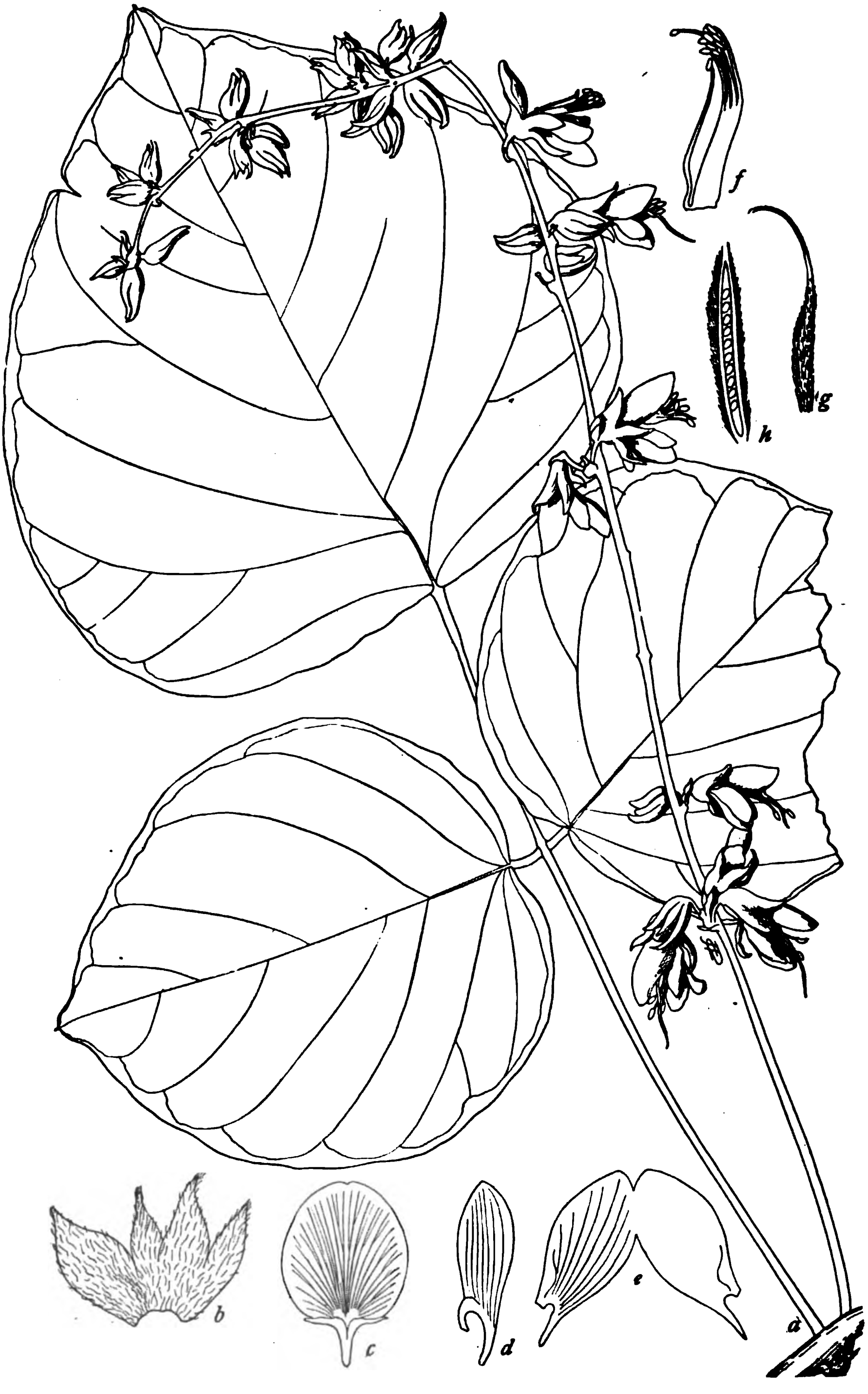
[a] See Bull. Torr. Club **26**: 111. 1899.



ODONIA INCANA ROSE.



ODONIA VIRIDIFLORA ROSE.

Type U. S. National Herbarium no. 450676, collected by Rose and Painter near Cuernavaca, Morelos, September 1903 (no. 6910); also by C. G. Pringle on lava beds near the same locality, September 14, 1896 (no. 6497); and by E. W. D. Holway near Cuautla, October, 1903 (no. 14).

Dr. Pringle's specimen was distributed as *Galactia tenuiflora*, from which, however, it is quite different.

Odonia viridiflora Rose, sp. nov. PLATE XXXIII.

A stout vine trailing or half-climbing over low bushes; stems covered with soft white pubescence; leaves 12 to 20 cm. long, 3-foliolate; leaflets nearly orbicular, the terminal one generally the largest, 6 to 10 cm. in diameter, rounded or slightly cordate at base, rounded at apex or with a short acumination, pubescent on both surfaces, paler and reticulated beneath; inflorescence much longer than the leaves, 20 to 30 cm. long including the peduncle; flowers 4 or 5 in a cluster; calyx 4-parted, the upper lobe broader, all acute; banner orbicular, the upper part of margin ciliate, green; wings narrow, purplish, spurred; ovary pubescent, many-ovuled; fruit 8 to 9 cm. long.

Type U. S. National Herbarium no. 381798, collected by C. G. Pringle near Iguala, Guerrero, October 24, 1900 (no. 9229, type); also in 1906 (no. 10324); near the same locality by Rose & Painter, August 11, 1905 (no. 9371); and by Dr. Pringle near Jojutla, Morelos, August 30, 1902 (no. 11366).

EXPLANATION OF PLATE XXXIII.—Fig. *a*, plant; *b*, calyx; *c*, banner; *d*, wing; *e*, keel; *f*, stamens *g*, style; *h*, ovary. Fig. *a*, natural size; figs. *b* to *g*, scale 2; *i*, scale 4.

THE SESSILE-FLOWERED SPECIES OF PAROSELA IN MEXICO.

In a former paper in this series[a] the reasons are given for taking up the name Parosela instead of Dalea, and a nearly completed list is supplied of the Mexican species with pediceled flowers. Below will be found the remaining species, so far as studied, arranged in the order in which I have classified them in my preliminary treatment. Further work in this genus may change this arrangement somewhat. There are perhaps still two dozen or even more species in Dalea not included in these lists, but since these are species not yet studied or whose exact status is not known it seems best not to consider them now. These will be reported upon in another paper after more study and further exploration in Mexico. Besides these, a considerable number of new species already indicated, but not yet all described, will be presented at another time. Names which have been previously published under Parosela are given without synonymy.

Parosela insignis (Hemsley) Rose.
Dalea insignis (Hemsley) Diag. Pl. Nov. **1**: 7. 1878.

Parosela uncifera (Schlecht. & Cham.) Rose.

Parosela scoparia (A. Gray) Heller.

Parosela glaberrima (S. Wats.) Rose.
Dalea glaberrima S. Wats. Proc. Am. Acad. **22**: 470. 1887.

Parosela lasianthera (A. Gray) Heller.

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[a] Number 4, Contributions, Volume VIII, page 302. 1905.

Parosela polyphylla (Mart. & Gal.) Rose.
Dalea polyphylla Mart. & Gal. Bull. Acad. Brux. **10**^{2}: 44. 1843.

Parosela citriodora (Willd.) Rose.
Dalea citriodora Willd. Sp. Pl. **3**: 1339. 1801.

Parosela mucronata (DC.) Rose.
Dalea mucronata DC. Prod. **2**: 246. 1825.

Parosela pectinata (Kunth) Rose.
Dalea pectinata Kunth, Mimos. 169. *pl. 49.* 1819.

Parosela grayi Vail.

Parosela acutifolia (DC.) Rose.

Parosela mutabilis (Cav.) Rose. [illegible] original reference

Parosela trochilina (Brandegee) Rose.
Dalea trochilina Brandegee, Proc. Cal. Acad. II. **3**: 220. 1892.

Parosela hemsleyana Rose, sp. nov.

A shrub with numerous long slender purplish branches closely set with glandular knobs, glabrous; leaves small; leaflets 9 to 15, 2 to 3 mm. long, obtuse, glabrous on both sides, very glandular-dotted beneath; peduncles slender; inflorescence a compact head; bracts broad; calyx silky, about 4 mm. long, including the lobes; lobes about two-thirds the length of the tube; corolla purplish.

Type U. S. National Herbarium no. 24436, collected by Parry and Palmer near San Luis Potosí, 1878 (no. 154). This is reported in the Biologia Centrali-Americana as *Dalea ramosissima* Benth., from which I think it is abundantly distinct. *D. ramosissima*, a Lower Californian species, has recently been collected by Mr. Brandegee and accords with Bentham's original description and excellent figure. Bentham's name must give way to the older one of Martius and Galeotti.

Parosela leucostachys (A. Gray) Rose.
Dalea leucostachys A. Gray, Pl. Fendl. 32. 1848.

Parosela lumholtzii (Rob. & Fern.) Vail.

Parosela eysenhardtioides (Hemsley) Rose.
Dalea eysenhardtioides Hemsley, Diag. Pl. Nov. **1**: 6. 1878.

Parosela oaxacana Rose, sp. nov.

Shrubs, 90 to 120 cm. high with many short ascending branches clothed with a short soft pubescence, each terminating in a short dense spike of purplish flowers; leaflets 6 to 15 pairs, narrowly oblong, 6 to 9 mm. long, pubescent on both sides when young but early glabrate, especially above, rounded at each end, apiculate, paler beneath, thickly set with small glands; bracts ovate, acuminate; calyx hairy, the tube not at all angled, slightly cleft on the upper side, the teeth much shorter than the tube, darker-colored, ovate, acute, almost spiny-toothed.

Type U. S. National Herbarium no. 40238, collected by Dr. C. G. Pringle on the Sierra de San Felipe, Oaxaca, altitude 2,250 meters, October 10, 1894 (no. 4961).

Parosela naviculifolia (Hemsley) Rose.
Dalea naviculifolia Hemsley, Diag. Pl. Nov. **1**: 7. 1878.

Parosela tuberculata (Lag.) Rose.
Dalea tuberculata Lag. Nov. Gen. & Sp. 23. 1816.

Parosela pulchella (Moric.) Heller.

Parosela psoralioides (Moric.) Rose.
Dalea psoralioides Moric. Mem. Geneve **6**: 533. 1833.

Parosela canescens (Mart. & Gal.) Rose.
Dalea canescens Mart. & Gal. Bull. Acad. Brux. **10^2**: 43. 1843.

Parosela polygonoides (A. Gray) Heller.

Parosela lachnostachys (A. Gray) Heller.

Parosela mollis (Benth.) Heller.

Parosela rubescens (S. Wats.) Vail.

Parosela inconspicua (Schauer) Rose.
Dalea inconspicua Schauer, Linnaea **20**: 744. 1847.

Parosela nana (Torr.) Heller.

Parosela wrightii (A. Gray) Vail.

Parosela vetula (Brandegee) Rose.
Dalea vetula Brandegee, Proc. Cal. Acad. II. **2**: 146. 1889.

Parosela cliffordiana (Willd.) Rose.
Dalea cliffordiana Willd. Sp. Pl. **3**: 1336. 1801.

Parosela revoluta (S. Wats.) Rose.
Dalea revoluta S. Wats. Proc. Am. Acad. **22**: 404. 1887.

Parosela pringlei (A. Gray) Heller.

Parosela laevigata (G. Don) Rose.
Dalea laevigata G. Don, Hist. Dichl. Pl. **2**: 224. 1832.

Parosela cyanea (Greene) Rose.
Dalea cyanea Greene, Pittonia **1**: 153. 1888.

Parosela brachystachys (A. Gray) Heller.

Parosela filiformis (A. Gray) Heller.

Parosela nigra (Mart. & Gal.) Rose.
Dalea nigra Mart. & Gal. Bull. Acad. Brux. **10^2**: 43. 1843.

Parosela lemmoni (Parry) Heller.

Parosela erythrorhiza (Greenman) Rose.
Dalea erythrorhiza Greenman, Zoe **5**: 185. 1904.

Parosela luisiana (S. Wats.) Rose.
Dalea luisiana S. Wats. Proc. Am. Acad. **17**: 341. 1882.

Parosela triphylla (Pav.) Rose.

Parosela aurea (Nutt.) Britton.

Parosela pogonanthera (A. Gray) Vail.

Parosela sericea (Lag.) Rose.
Dalea sericea Lag. Nov. Gen. & Sp. **23**: 1816.

Parosela gracilis (Kunth) Rose.
Dalea gracilis Kunth, Mimos. 166. *pl. 48.* 1819.

Parosela painteri Rose, sp. nov.

Stems bushy, forming large clumps 30 to 50 cm. high, woody below; branches clothed with short appressed pubescence, dark-colored, with few or no glands; leaflets 5 to 7 pairs, oblong, 5 mm. long, retuse, glabrous and glandless above, glandular and slightly pubescent beneath; spikes at first globular, becoming in fruit 3 cm. long; bracts ovate, acute, a little hairy, deciduous; calyx tube broad, glabrous and shining without and bearing a row of black glands between the ribs; calyx teeth linear, somewhat unequal, about the length of the tube; petals yellow or the keel and wings somewhat reddish; fruit pubescent.

Type U. S. National Herbarium no. 453017, collected by J. N. Rose and Jos. H. Painter on a stony hillside near San Juan del Rio, Querétaro, August 18, 1905 (no. 9526). Resembling *P. plumosa*, but leaflets smaller and glabrous above, stems darker-colored, spikes shorter, etc.

Parosela pauciflora Rose, sp. nov.

Woody at base, much branched, about 60 cm. high, the young branches finely pubescent; leaflets 7 to 9 pairs, sometimes reduced to 3 pairs, small, 4 to 7 mm. long, oblong, acute or mucronate, hairy on both sides, glandular beneath; bracts lanceolate, acuminate, rather conspicuous, hairy; calyx tube short, hairy, the teeth ovate at base tapering into long subulate tips longer than the the calyx tube; petals small, white; keel and wings borne on the stamen tube a little below the top; ovary hairy.

Type U. S. National Herbarium no. 316752, collected by C. G. Pringle in shaded places on hills near Guadalajara, Jalisco, December 12, 1888 (no. 1825).

Parosela watsoni Rose, sp. nov.

Perennial, with at least upper branches herbaceous, very villous; leaflets 9 to 11 pairs, hairy on both sides, linear-oblong, obtuse, 3 to 5 mm. long; spikes narrow, very densely flowered; bracts linear to filiform, hairy; calyx hairy, the teeth longer than the tube; petals small, white.

Type U. S. National Herbarium no. 24472, collected by Dr. E. Palmer at Frayles, Chihuahua, 1885 (no. 252), and briefly described but not named by Dr. S. Watson.[a]

Parosela albiflora (A. Gray) Vail.

Parosela eriophylla (S. Wats.) Rose.
Dalea eriophylla S. Wats. Proc. Am. Acad. **17**: 340. 1882.

Parosela seemani (S. Wats.) Rose.
Dalea seemani S. Wats. Proc. Am. Acad. **22**: 470. 1887.

Parosela greggii (A. Gray) Heller.

Parosela wislizeni (A. Gray) Vail.

Parosela argyrostachys (Hook. & Arn.) Rose.
Dalea argyrostachys Hook. & Arn. Bot. Beech. Voy. 285. 1841.

Parosela plumosa (S. Wats.) Rose.
Dalea plumosa S. Wats. Proc. Am. Acad. **21**: 448. 1886.

Parosela leucostoma (Schlecht.) Rose.
Dalea leucostoma Schlecht. Linnaea **12**: 294. 1838.

Parosela domingensis (DC.) Heller.

Parosela formosa (Torr.) Vail.

Parosela purpusi (Brandegee) Rose.
Dalea purpusi Brandegee, Erythea **9**: 2. 1899.

Parosela berlandieri (A. Gray) Rose.
Dalea berlandieri A. Gray, Proc. Am. Acad. **5**: 177. 1861.

Parosela microphylla (H. B. K.) Rose.
Dalea microphylla H. B. K. Nov. Gen. & Sp. **6**: 482. 1823.

Parosela brandegei Rose.
Dalea ramosissima Benth. Pl. Hartw. 1844, not *D. ramosissima* Mart. & Gal. 1843

Named for Mr. Brandegee, who has called attention to the fact that two species

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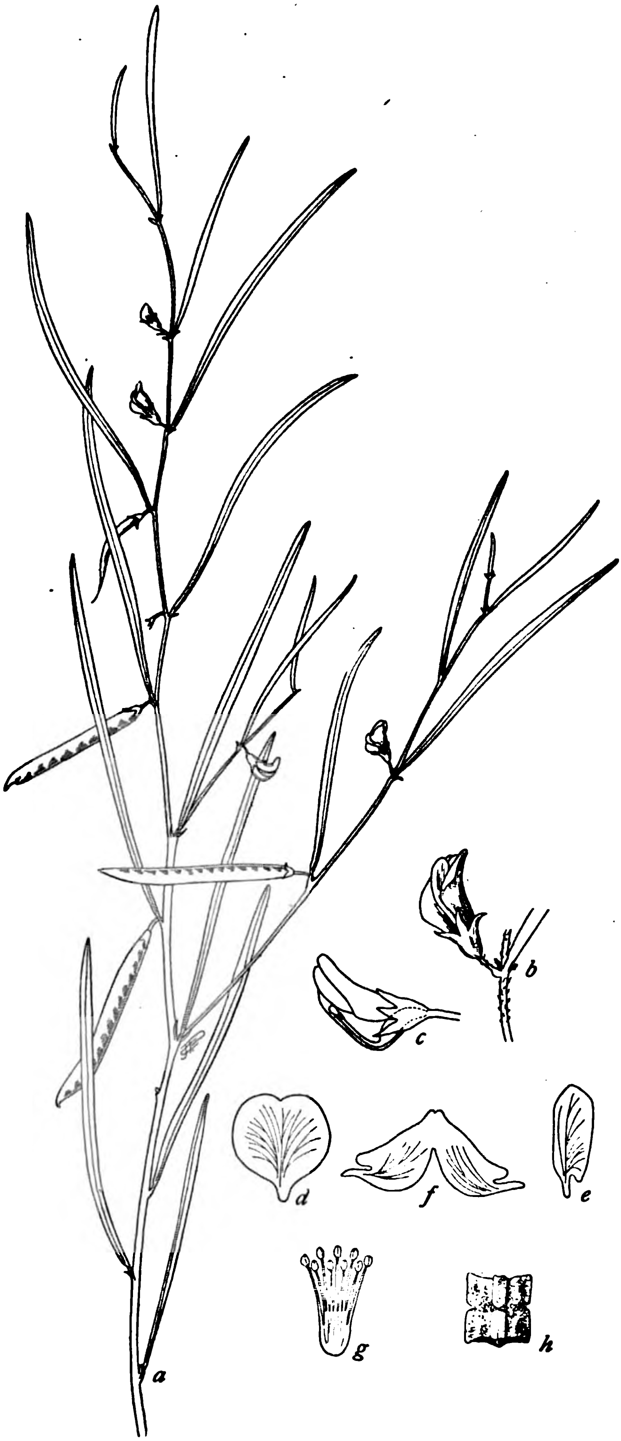
[a] Proc. Am. Acad. **21**: 424. 1886.



SPHINCTOSPERMUM CONSTRICTUM (S. WATS.) ROSE.

are passing under the name of *D. ramosissima* and who has recently re-collected and distributed Bentham's species.

Parosela lasiostachya (Benth.) Rose.
Dalea lasiostachya Benth. Pl. Hartw. 11. 1839.

Parosela emoryi (A. Gray) Heller.

SPHINCTOSPERMUM, A NEW GENUS.

Sphinctospermum Rose, gen. nov.

Calyx teeth 5, acuminate, the 2 upper more united than the others; petals nearly equal in length; banner nearly orbicular; wings oblong; stamens 10, one free to the base, style slender, hairy near the top; ovaries sessile, many-ovuled; pods linear, 2-valved, septate between the seeds, 6 to 10-seeded; seeds shortly oblong, 4-angled, constricted in the middle suggesting miniature vertebrae, dull-colored and minutely roughened.

Annuals with simple linear leaves and single (rarely paired) axillary flowers. In its flowers and pods suggesting some species of Cracca (Tephrosia), such as *C. tenella.* Its annual habit, simple leaves, and axillary flowers, and especially its most remarkable seeds, exclude it positively from Cracca.

Sphinctospermum constrictum (S. Wats.) Rose. PLATE XXXIV.
Tephrosia constricta S. Wats. Proc. Am. Acad. **24**: 46. 1889.
Reported from western Sonora and Lower California.

EXPLANATION OF PLATE XXXIV.—Fig. *a*, plant; *b* and *c*, flowers; *d*, banner; *e*, wing; *f*, keel; *g*, stamens; *h*, seed. Fig. *a*, natural size; *b* to *g*, scale 3; *h*, scale 4.

KRAMERIACEAE.

THE NORTH AMERICAN SPECIES OF KRAMERIA.

Our knowledge of the species of Krameria has been very meagre, especially that of the Mexican ones. Recently collectors in Mexico have not only found new species, but rediscovered some of the very rare ones, such as *K. cuspidata*, *K. revoluta*, and *K. parvifolia.* Of the fifteen species which we now recognize from North America, all except *K. lanceolata* are represented in our Mexican collection. The following are the North American species:

Krameria bicolor S. Wats. Proc. Am. Acad. **21**: 417. 1896.

Krameria cuspidata Presl, Rel. Haenk. **2**: 103. 1835–36.

Krameria cytisoides Cav. Ic. **4**: 61. *pl. 390.* 1797.

Krameria diffusa Rose & Painter, sp. nov.

Perennial with long diffuse herbaceous branches and scant pubescence; leaves linear, 1 to 2 cm. long, acute, becoming glabrate; inflorescence racemose; peduncles 10 to 15 mm. long, bibracteate above the middle; flowers large, purple; fruit small, globular, with a few short stout spines, these either naked or with very short retrorse hairs.

Type U. S. National Herbarium no. 452798 (Rose no. 9311), apparently common on the west coast of Mexico, extending from Sinaloa to Guerrero.

Specimens examined:

Sinaloa: Ymala, Dr. E. Palmer, September 25 to October 8, 1891 (no. 1671).

Morelos: Near Puenta de Ixtla, J. N. Rose and Robert Hay, July 4, 1901 (no. 5326).

Guerrero: Near Iguala, J. N. Rose and Jos. H. Painter, August 10 and 12, 1905 (no. 9311).

Krameria glandulosa Rose & Painter.

Low compact shrubs, the branches often forming long weak spines; the bark on old branches dark or sometimes bleaching out; young branches clothed with long cinereous appressed hairs; leaves linear, with cinereous pubescence, tipped by a long deciduous mucro; peduncles and calyx and often the branches and leaves covered with black glandular hairs; sepals and petals purplish; fruit flattened, ovate in outline, covered with long purple barbed hairs.

Type U. S. National Herbarium no. 346914, collected by J. N. Rose near El Paso, Texas, May 8, 1899 (no. 4904). This species is distributed from western Texas to California, extending north into Utah and south into northern Mexico. It has long been known as *K. parvifolia* Benth., but that species is confined to southern Lower California, has much greener foliage, less mucronate leaves, red branches, reddish yellow flowers, etc.

Krameria grayi Rose & Painter.
Krameria canescens A. Gray, Pl. Wright. **1**: 42. 1852, not Willd., 1825.

Krameria lanceolata Torr. Ann. Lyc. N. Y. **2**: 168. 1828.

Krameria palmeri Rose, Contr. Nat. Herb. **1**: 304. *pl. 27*. 1895.

Krameria parvifolia Bentham, Bot. Voy. Sulph. 6. *pl. 1*. 1844.

Krameria paucifolia Rose. 451
Krameria canescens paucifolia Rose, Contr. Nat. Herb. **1**: 661. 1890.

Krameria pauciflora DC. Prod. **1**: 341. 1824.

Krameria ramosissima (A. Gray) S. Wats. Proc. Am. Acad. **17**: 326. 1882.
Krameria parvifolia ramosissima A. Gray, Pl. Wright. **1**: 41. 1852.

Krameria revoluta O. Berg, Bot. Zeit. **14**: 751. 1856.

Krameria secundiflora DC. Prod. **1**: 341. 1824.

Krameria interior Rose & Painter, sp. nov.

Shrub, much branched, with black shreddy bark; young branches with cinereous, appressed pubescence; leaves linear, 12 to 20 mm. long, mucronate-tipped; flowers not seen; fruiting peduncles 15 mm. or less long, bibracteate; fruit globular, the body 8 mm. long; spines with retrorse hairs along the upper half.

Type U. S. National Herbarium no. 301352, collected by J. N. Rose near San Juan Capistrano, Zacatecas, August 19, 1897 (no. 2441).

GERANIACEAE.

THREE NEW SPECIES OF GERANIUM.

Geranium bellum Rose, sp. nov.

Resembling *G. schiedeanum*, but the flowers always white, the sepals much broader, the outer ones 4 or 5-nerved, and the leaf segments much more obtuse.

Very common in the high mountains of Central Mexico, frequently collected by the writer and recently by Dr. C. G. Pringle.

Type U. S. National Herbarium no. 395386, collected by J. N. Rose and Robert Hay on Sierra de Pachuca, Hidalgo, July 21 and 22, 1901 (no. 5618).

Geranium lozani Rose, sp. nov.

Perennial; stems several, arising from the base or near it, 20 to 30 cm. high, either nearly glabrous or with a rather scanty pubescence consisting of rather short reflexed hairs; basal leaves long-petioled; blades orbicular in outline, 3 to 5-lobed, the lobes usually 3-cleft and strongly toothed, coriaceous in texture, scarcely if at all paler beneath, a little pubescent on both surfaces; peduncle extending beyond the leaves, 2-flowered; pedicels elongated, 5 to 7 cm. long; sepals broadly lanceolate, 3-nerved, inner ones ciliate; petals white, veined with red, 14 mm. long; fruit narrow, 3 cm. long, pubescent.

U. S. National Herbarium no. 461465, collected by C. G. Pringle and F. Lozano near Buena Vista Station, Hidalgo, altitude 2,550 meters, 1904 (no. 8994).

Geranium pringlei Rose, sp. nov.

Perennial; stems erect, about 30 cm. high, very pilose, especially at base, the upper part of the stem and inflorescence with numerous purple stipitate glands; basal leaves long-petioled, white-pilose, especially below the blade, deeply lobed, each lobe cleft and sharply toothed; stem leaves somewhat similar but shorter-petioled; peduncles usually 2-flowered; pedicels short, 1 to 2 cm. long, densely glandular-pubescent; sepals lanceolate, faintly 3-nerved, the inner ones ciliate; petals blue, large; fruit linear, pubescent, with stipitate glands.

Type U. S. National Herbarium no. 461451, collected by C. G. Pringle in meadows, Cuyamaloya Station, in eastern Hidalgo, altitude 2,490 meters, August 2, 1904 (no. 8978).

OXALIDACEAE.

INTRODUCTORY NOTE.

The breaking up of Oxalis by Dr. J. K. Small[a] into several genera has been variously received by botanists. My own view of the subject is that his ground has been well taken and his treatment is followed in this paper. Oxalis proper is not found in Mexico, but all the segregates made by Doctor Small are represented, and in addition to these Biophytum and Pseudoxalis, the latter here described for the first time.

For more than ten years I have been studying the Mexican material of this family, in which I have found many new species, some of them here first described.

SOME MEXICAN SPECIES OF IONOXALIS.

In Mexico Ionoxalis might well be called the harbinger of spring, for it is one of the first plants to respond to the rains which break up the long dry season and is the very first to give color to the landscape. One may travel for many miles north of the City of Mexico and see the high valleys and plains blue, pink, or white with Ionoxalis while most other vegetation has hardly started. Of the 35 named species of Oxalis credited to Mexico and Central America by Hemsley 15 belong to this genus, but the actual number is greatly in excess of this figure.

The genus has a wide range both horizontal and altitudinal. It is scattered over the entire length and breadth of the country, reaching from near the sea level to the tops of many of the high mountains; it grows on the open plain, in woods, in cultivated fields as a weed, on nearly barren rocks, on dry exposed hillsides, and in sandy nooks under the influence of the spray of a waterfall. Some species grow on nearly perpendicular cliffs, others on the level so thickly set together as to form a sod, while others are scattered or solitary.

The following comprise most of the Mexican species.

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[a] Flora of the Southeastern United States, p. 664. 1903.

Ionoxalis alpina Rose, sp. nov.

Bulbs solitary; leaves radical, several; petioles slender, glabrous; leaflets 3, broadly cuneate, strongly notched, glabrous, pale beneath; peduncle long, longer than the leaves, glabrous, 2 or 3-flowered; involucral bracts small, slightly pubescent; pedicels long (2.5 to 5 cm.) and slender, somewhat unequal; sepals lanceolate, 4 mm. long, obtuse or acutish, glabrous with scarious margins; petals white, large, 20 mm. long; 5 of the stamens a little longer than the others; filaments glabrous below, slightly hairy at the top.

Type U. S. National Herbarium no. 304004, collected by Dr. C. G. Pringle on Sierra de las Crucis, Mexico, altitude 3,000 meters, August 13, 1896 (no. 6439).

Ionoxalis amplifolia (Trelease) Rose.

Oxalis divergens amplifolia Trelease in A. Gray, Syn. Fl. 1^1: 368. 1897.

This form seems to deserve specific rank. It is characterized by broad obcordate leaflets, the lobes short and rounded. Doctor Trelease determined it as a form of *O. divergens*, a species of South Mexico having white flowers.

I have referred here tentatively a specimen collected by Palmer near Durango, 1896 (no. 297).

Ionoxalis bipartita Rose, sp. nov.

Bulbs globose, small, the scales many-nerved, ciliate; buds and young parts hairy; leaflets 3, a little hairy, deeply 2-lobed; lobes widely spreading, linear and elongated, obtuse; sepals 3 mm. long, obtuse, 2-glandular at tip; petals pale blue (?), small, 6 mm. long; stamens 10, united below, of two lengths, the longer ones hairy; ovary sessile or nearly so; styles long and short in different flowers; fruit oblong-linear, 5 mm. long.

Type U. S. National Herbarium no. 461290, collected by C. G. Pringle near Cuernavaca, Morelos, July, 1898 (no. 6896); also collected in the same locality by J. N. Rose, May, 1899 (no. 4365).

This species resembles *I. stipitata* of the Valley of Mexico, but has different leaflets, flowers, etc.

Ionoxalis compacta Rose, sp. nov.

Plants glabrous, growing in clusters on rocks in dark canyons; bulbs small, the coats 1-nerved, small; leaflets 3, small, wedge-shaped, retuse at apex; peduncles longer than the leaves, 2 to 4-flowered; pedicels slender, about 2 cm. long; sepals lanceolate, obtuse, 2.5 mm. long; petals pale lilac, 10 mm. long; 5 longer stamens slightly hairy.

Type U. S. National Herbarium no. 302425, collected by J. N. Rose in a canyon near top of the Sierra Madre just below the little village of Santa Teresa, Tepic, altitude about 2,400 meters, August 12, 1897 (no. 3448).

Perhaps nearest *I. gregaria*, but with different leaflets, fewer and larger flowers, etc.

Ionoxalis confusa Rose, sp. nov. PLATE XXXV, FIGURE 1.

Resembling *I. furcata;* leaflets glaucous and much deeper-cleft (usually to below the middle); sepals glabrous; flowers more numerous and smaller; capsule linear-oblong, 7 mm. long; stamens of two lengths, the short ones glabrous, the long hairy.

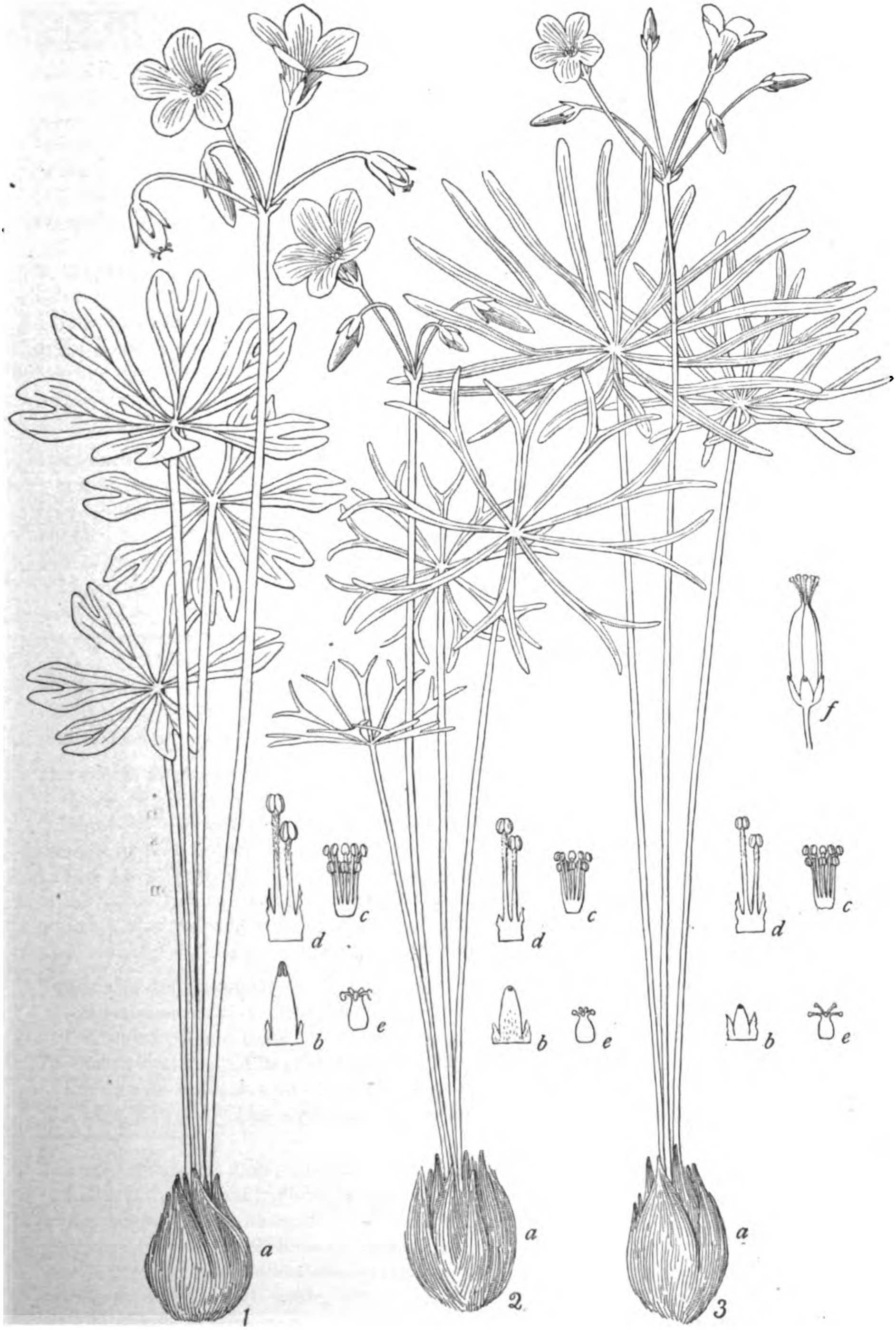
Type U. S. National Herbarium no. 305682, collected by Dr. C. G. Pringle on wet banks near Guadalajara, Jalisco, June, 1889 (no. 2789).

This species was distributed as *O. decaphylla* H. B. K., from which it proves to be very distinct.

EXPLANATION OF PLATE XXXV, FIG. 1.—Fig. *a*, plant; *b*, sepal; *c*, *d*, stamens; *e*, ovary. Fig. *a*, natural size; *b* to *e*, scale 2.

Ionoxalis conzattiana Rose, sp. nov.

Bulbs solitary, rather large, surrounded by a bundle of fibers; bulb-scales orbicular, with many nerves (15 or more); leaflets 4 to 6, orbicular to shortly oblong, rounded



IONOXALIS CONFUSA ROSE, I. FURCATA ROSE, AND I. JALISCANA ROSE.

at apex, 2 to 3 cm. long, somewhat hairy even in age, glaucous beneath, the margin and tip with scattered brown glands; peduncles often much longer than the leaves and appearing with them, 20 to 30 cm. long; flowers numerous, on slender pedicels; sepals lanceolate, 5 to 8 mm. long, obtusish, thin, purplish-margined, bearing a brown gland at tip; flowers deep purple; petals 12 to 20 mm. long; filaments a little pubescent; styles hairy.

Type U. S. National Herbarium no. 346561, collected by J. N. Rose and Walter Hough on Mount Alban near city of Oaxaca, June 16 to 21, 1899 (no. 4586).

I also refer here, although it has much larger flowers, a specimen collected by E. W. Nelson on the west slope of Mount Zempoaltepec, Oaxaca, July, 1894 (no. 550).

This is one of the largest-flowered species of the genus which I have seen in Mexico and would doubtless be worthy of introduction into cultivation. I have named it for my friend Professor Conzatti, of Oaxaca, who conducted me to the region in which the plant was found and to whom I am under many obligations for courtesies shown me while in his city.

Ionoxalis cuernavacana Rose, sp. nov.

Bulbs large, deep-seated, clothed without with stout fibers; bulb scales acute, broad, with numerous strong nerves; leaflets 4, broadly cuneate, rounded or broadly notched at apex, in age glabrate, pale beneath, 3 to 6 cm. long, 2 to 4 cm. broad; peduncles stout, appearing before the leaves; flowers mostly 6 to 12, sometimes reduced to one; sepals oblong, obtuse, gland-tipped; flowers reddish or purplish; petals 12 to 15 mm. long; stamens of two lengths, the longer toothed on one side, glandular-pubescent, the others hairy.

Type U. S. National Herbarium no. 346366, collected by J. N. Rose in deep woods in the canyon above Cuernavaca, Morelos, May, 1899 (no. 4401); also near the same locality by C. G. Pringle, June, 1896 (no. 6344). Bulbs were sent home by the writer which flowered in the Botanical Garden in September, 1899.

Ionoxalis decaphylla (H. B. K.) Rose.

Oxalis decaphylla H. B. K. Nov. Gen. & Sp. **5**: 538. *pl. 468.* 1821.

Humboldt's illustration of this species shows a plant with 10 leaflets somewhat cuneate at base and strongly notched at apex. The material which has been referred to this species comes from widely separated stations and shows a considerable variation in the size and shape of the leaflets. A good part of it seems to belong elsewhere. Material which I collected in the Valley of Mexico is very nearly typical, and, if really so, it will exclude all the northern material.

Ionoxalis drummondii (A. Gray) Rose.

Oxalis drummondii A. Gray, Pl. Wright. **2**: 251. 1853.

I. drummondii has been reported in Sonora by Torrey, but no specimens are cited by Doctor Trelease. I have seen only the Mexican Survey specimens cited by Torrey.

The species is characterized by the broadly spreading lobes of the leaflets and by the blue flowers. The scales of the bulbs are thin and 3-nerved, the stamens glabrous.

Ionoxalis furcata Rose, sp. nov. PLATE XXXV, FIGURE 2.

Bulbs solitary, small, globular, covered with the fibers of the old scales; scales ovate, acute, many (more than 10)- nerved; petioles shorter than the peduncles, glabrous; leaflets 7 to 9, linear in outline, glabrous, each two-cleft; lobes about one-fourth the length of the leaflets, diverging, linear, obtuse; peduncles 3 to 7-flowered; involucral bract small, ovate, acute; pedicels slender, 10 to 12 mm. long; sepals shortly oblong, 3 mm. long, obtuse or rounded at apex, 3-nerved, pubescent; corolla purplish, 10 to 12 mm. long; stamens all hairy; styles (in specimens seen) of one length and very short; capsule not seen.

Type U. S. National Herbarium no. 396715, collected by C. G. Pringle on wet ledges near Guadalajara July 10, 1902 (no. 8659). Here perhaps belongs J. N. Rose's no. 6402 collected in 1901 near the same locality.

Explanation of Plate XXXV, Fig. 2.—Fig. *a*, plant; *b*, sepals; *c* and *d*, stamens; *e*, ovary. Fig. *a*, natural size; *b* to *e*, scale 2.

Ionoxalis galeottii (Turcz.) Rose.

Oxalis galeottii Turcz. Bull. Soc. Nat. Mosc. **31**^{1}: 433. 1858.

Type locality; "Oaxaca, altitude 7,000 ped.;" type collected by Galeotti (no. 3995).

Specimens examined:

Oaxaca: Sierra de San Felipe, altitude 2,700 and 3,000 meters, C. G. Pringle, May, 1894 (no. 4660).

I have seen no authentic specimens of this species, but Doctor Pringle's plant comes from the same general locality and answers the description fairly well.

Ionoxalis gonzalesii Rose, sp. nov.

Bulbs solitary, globular, covered with many fine fibers; scales with numerous nerves; leaflets about 9, broadly linear, 6 to 7 cm. long, acute, glabrate in age; peduncles 20 to 30 cm. long; umbels many-flowered; pedicels slender, 1 to 2 cm. long; sepals ovate, obtuse, glabrous; petals 1 cm. long, deep purple; styles long, hairy.

Type U. S. National Herbarium no. 371938, collected by C. Conzatti and V. Gonzales on San Felipe, Oaxaca, June 10, 1897 (no. 333).

This species is perhaps nearest *O. lasiandra*, but it has differently shaped leaflets, glabrous sepals, etc.

Ionoxalis grayi Rose, sp. nov.

Bulbs surrounded by a thick coat of old fibers; scales thickish, many-nerved; leaflets 5 to 8, simply notched, or deeply parted; peduncles longer than the leaves; flowers purplish; filaments hairy.

This is the *Oxalis decaphylla* of Gray and of all American writers. It differs greatly from the material from the Valley of Mexico in the texture of the bulb scales and in having numerous veins instead of three. I have referred tentatively to this species all the material heretofore passing under *O. decaphylla* except that from the Valley of Mexico, although there may be other forms which should be taken out. I have taken for the type U. S. National Herbarium no. 14731, the first specimen (Wright's no. 909) wrongly referred to *O. decaphylla.*

Ionoxalis gregaria Rose, sp. nov.

Plants growing in thin sheets on the sides and in crevices of dark overhanging cliffs; bulbs numerous, small, in flowering specimens almost entirely absorbed, apparently arising from slender rhizomes; leaflets 3, sharply cuneate at base, broad above, retuse, the lobes rounded, 6 to 30 mm. long, pale or sometimes violet-colored, glabrous or nearly so; peduncles much longer than the leaves, many-flowered; pedicels very slender, elongated, sometimes 25 mm. long; flowers small; calyx lobes shortly oblong, obtuse, 1 to 2 mm. long, glandular at tip; petals pale lilac, 6 to 8 mm. long; stamens hairy.

Type U. S. National Herbarium no. 40240, collected by C. G. Pringle in the barranca below Cuernavaca, Morelos, 1896 (no. 6343); also collected at the same locality by J. N. Rose, May, 1899 (no. 4437).

It differs from most of the other described species in its clustered bulbs. Apparently of the type of *O. martiana*, but certainly different.

Ionoxalis hernandesii (DC.) Rose.

Oxalis hernandesii DC. Prod. **1**: 695. 1824.

This species has a wide distribution and shows considerable variation in the size and shape of the leaflets. The leaflets, however, are never retuse.

In the U. S. National Herbarium we have some 16 sheets of this species.

Ionoxalis jacquiniana (H. B. K.) Rose.

Oxalis jacquiniana H. B. K. Nov. Gen. & Sp. 5: 235. 1821.

Type locality: "Prope Real del Monte."

Ionoxalis jaliscana Rose, sp. nov. PLATE XXXV, FIGURE 3.

Bulbs solitary, globular; scales closely many-nerved; petioles scarcely half as long as the peduncles, glabrous; leaflets 5 to 8, broadly cuneate, 6 to 12 mm. broad above, deeply 2-notched or slightly lobed, the lobes broad and obtuse; flowers 5 to 8; pedicels slender, 10 to 12 mm. long; sepals 5 mm. long, oblong, acute, glabrous; corolla purplish, 15 mm. long; styles (in specimens seen) all very short and glabrous; capsule oblong, about twice as long as the sepals, glabrous.

Type U. S. National Herbarium no. 396712, collected by C. G. Pringle near Guadalajara, Jalisco, July 12, 1902 (no. 8646), also collected near the same locality by Dr. E. Palmer in 1896 (no. 68). The latter plant was referred by Dr. S. Watson to *Oxalis decaphylla*, from which it is readily distinguished by its bulb scales, leaflets, etc.

EXPLANATION OF PLATE XXXV, FIG. 3.—Fig. *a*, plant; *b*, sepal; *c* and *d*, stamens; *e*, ovary; *f* fruit. Fig. *a*, natural size; *b* to *f*, scale 2.

Ionoxalis latifolia (H. B. K.) Rose.

Oxalis latifolia H. B. K. Nov. Gen. & Sp. 5:237. *pl. 467*. 1823.

This species as heretofore understood has had a wide range extending, according to some authorities, from the southern United States through Mexico and Central America to South America, and from Campeche on the coast to high upon Mount Orizaba.

The only specimens I have seen which at all seem to answer Humboldt's illustration are those collected by Doctor Gaumer (no. 585) and by Doctor Schott (nos. 490 and 918), in both cases in Yucatan, therefore from near the type locality.

As I understand this species it is characterized by broadly cuneate leaflets which are rather strongly nerved, small flowers, small, broad, obtuse sepals, hairy stamens, and a stipitate ovary.

Ionoxalis lasiandra (Zucc.) Rose.

Oxalis lasiandra Zucc. Abh. Akad. Muench. 2: 353. 1834.

A condensed description is as follows: Leaflets 7 to 9, 7.5 cm. long, 2.5 cm. broad, rounded at apex; sepals with glandular hairs outside; petals large, crimson; filaments glandular-pubescent. This species is now grown in the open grounds of the Washington Botanical Garden, having come from Edinburgh, the original source of the Graham material. Mr. George Oliver tells me that it is very common in the grounds of the Botanical Garden of Edinburgh, sometimes becoming a weed.

Oxalis lasiandra Zucc. and *O. lasiandra* Graham have been heretofore considered distinct species, Graham's name being the one in general use. After a careful comparison of the original descriptions I am led to believe that the name as used by both authorities refers to the same species. Zuccarini described his plant about 1834 (?), having grown it from bulbs sent by Karwinski from Mexico to the botanical garden at Munich. The species being such an attractive one would naturally be distributed. In 1840 Graham received specimens from Berlin under the manuscript name of *O. lasiandra*, which name he used in 1842 when he figured and described it in the Botanical Magazine. Zuccarini should therefore be cited as the authority for this name.

The Kew Index reference of Graham's plant to *O. floribunda* Lehm., a Brazilian species, must be incorrect.

Ionoxalis lunulata (Zucc.) Rose.

Oxalis lunulata Zucc. Abh. Math. Phys. Classe 1:200. 1830.

In the Bernhardi Herbarium, now in the Missouri Botanical Garden, is what appears to be a part of the type of *O. lunulata*. It seems to answer that species in every particular, character of bulb scales, size, number, and shape of leaflets, number and color of flowers, etc. The label gives the locality "Mexico."

Ionoxalis occidentalis Rose, sp. nov.

Bulbs solitary, deep-seated; bulb scales acuminate, strongly many (about 20) nerved, some of the nerves anastomosing; leaflets 4 to 6, rather thick, strongly notched at apex, cuneate at base, glabrous; peduncles elongated, much longer than the leaves and appearing with them; flowers 4 to 7, on slender pedicels 2 to 3 cm. long; sepals broadly oblong, 6 to 7 mm. long, rounded or even truncate at the apex, thin with broad purple margins, glabrous, with 3 or 4 glands near tip; petals deep purple above, pale below, 2 cm. long; filaments somewhat hairy; styles pubescent.

Type U. S. National Herbarium no. 301992, collected by J. N. Rose on the road between Bolaños and Guadalajara, but in the State of Zacatecas, September 20, 1897 (no. 3035).

This is a very beautiful species, worthy of cultivation.

Ionoxalis primavera Rose, sp. nov.

Bulbs of medium size; scales oblong, very fibrous, the nerves 12 or more; leaflets 3, triangular in outline more or less strongly lobed at apex, the lobes generally broad and rounded at apex; peduncles 20 to 30 cm. long, nearly twice as long as the leaves; pedicels and calyx glandular-pubescent even in age; flowers numerous, purplish; sepals lanceolate, obtusish, glandular at tip, 5 to 6 mm. long; petals 12 to 16 mm. long; pubescent within; filaments only slightly pubescent.

Very common in the lowlands of Tepic and Sinaloa, where it was collected by J. N. Rose, July 2, 1897 (no. 1508). This specimen, the type, from Acaponeta, Tepec, is no. 300348 of the U. S. National Herbarium.

This plant begins to flower a few days after the first rains and is one of the very earliest of the herbaceous plants to appear on the dry plains of western Mexico. Later in the season it is so abundant that it becomes a troublesome weed in cornfields.

This species has been in cultivation since 1897 in the Washington Botanical Garden, where it has flowered several times.

Ionoxalis pringlei Rose, sp. nov.

Bulbs solitary; leaves radial, several; petioles slender, glabrous; leaflets broadly cuneate, obcordate, glabrous, 10 to 20 mm. broad; peduncle 15 to 25 cm. long, much longer than the leaves, glabrous, 2 to 8-flowered; involucral bracts small, slightly pubescent, acute, gland-tipped; peduncles 12 to 35 mm. long, slender; sepals ovate, acute, 4 mm. long, glabrous, with scarious margins and gland-tipped; petals blue, yellowish below, 10 mm. long; 5 filaments longer than the others; capsule linear, elongated, 15 mm. long.

Type U. S. National Herbarium no. 304003, collected by Dr. C. G. Pringle on lava beds on the side of Sierra de Ajusco, Distrito Federal, altitude 2,550 meters, September 8, 1896 (no. 6483).

Ionoxalis schiedeana (Zucc.) Rose.

Oxalis schiedeana Zucc. Abh. Math. Phys. Classe **2**: 352. 1834.

Ionoxalis stipitata Rose, sp. nov.

Bulbs globular, small, covered with thin coats, these with about 8 to 10 delicate nerves, ciliate; young buds hairy; leaflets 3, becoming glabrate, 2-lobed; lobes widely spreading, linear-oblong, obtuse; sepals oblong, 4 mm. long, obtuse, purplish at tip, 2-glandular; petals pale blue, 11 mm. long; stamens 10, united below, of two lengths; free part of filaments broad below, the 5 longer filaments hairy, the 5 shorter glabrous; ovary stipitate; styles (in specimens seen) long, hairy; fruit rather broad, one and one-half times longer than the sepals.

Type U. S. National Herbarium no. 40241, collected by C. G. Pringle, near Tlalnepantla, Valley of Mexico, July 5, 1898 (no. 6894).

Ionoxalis stolonifera Rose, sp. nov. For description see p. 131.

Ionoxalis tenuiloba Rose, sp. nov.

Bulbs solitary; petioles about the length of the peduncle, glabrous; leaflets 3, cuneate at base, deeply 2-lobed; lobes strongly divergent, linear, 2.5 to 5 cm. long, acute; peduncle filiform, 10 to 12 cm. long; umbel about 8-flowered; pedicels filiform, 2.5 mm. long; sepals obtuse, gland-tipped; filaments hairy.

Type U. S. National Herbarium no. 236917, collected by Marcus E. Jones at Colima, State of Colima, July 2, 1892 (no. 118).

This species has very remarkable leaflets.

Ionoxalis tetraphylla (Cav.) Rose.

Oxalis tetraphylla Cav. Ic. **3**: 19. *pl. 237.* 1794.

Oxalis deppei Lodd. Bot. Cab. **15**: *pl. 1500.* 1828.

Type locality: "In Mexico Imperio."

I have referred to this species a plant collected by myself on the pedregal at San Angel near the City of Mexico, which, from its appearance and station, is more likely to belong here than any other which I have seen. Cavanilles's figure shows a plant with 3 or 4 broad, obovate leaflets and with elongated peduncles and slender pedicels, all of which are possessed by my specimen.

Ionoxalis vespertilionis (Zucc.) Rose.

Oxalis vespertilionis Zucc. Abh. Math. Phys. Classe **2**: 350. 1834.

MEXICAN AND CENTRAL AMERICAN SPECIES OF LOTOXALIS.

The following Mexican species of Lotoxalis are either new or have been passing as species of Oxalis.

Lotoxalis angustifolia (H. B. K.) Rose.

Oxalis angustifolia H. B. K. Nov. Gen. & Sp. **5**: 249. 1823.

Lotoxalis dichotoma Rose, sp. nov.

Woody for some distance below, slender, erect, rarely if at all branching, somewhat hairy, 30 to 60 cm. high; petioles slender, 2 to 7 cm. long, somewhat pilose; leaflets orbicular to oblong, 2 to 4 cm. long, rounded at base and apex or sometimes obtuse, thin, more or less hairy on both sides, paler beneath, the terminal leaflet remote; pedicels slender, 2 to 7 cm. long, longer than the subtending petiole, dichotomously branching with a single flower in the fork, several-flowered; sepals 4 mm. long, slightly hairy; petals yellow, twice as long as the sepals; stamens glabrous.

Type U. S. National Herbarium no. 300500, collected by J. N. Rose in the foothills of the Sierra Madre, near Colomas, Sinaloa, July, 1897 (no. 1650).

This species belongs to the group Hedysaroideae, and is closely related to the so-called *Oxalis sepium*.

Lotoxalis fasciculata (Turcz.) Rose.

Oxalis fasciculata Turcz. Bull. Soc. Nat. Mosc. **32**[1]: 272. 1859.

Lotoxalis glabrata (Baker) Rose.

Oxalis neaei glabrata Baker, Ref. Bot. **5**: *pl. 292.* 1871.

Lotoxalis neaei (DC.) Rose.

Oxalis neaei DC. Prod. **1**: 690. 1824.

Lotoxalis occidentalis Rose, sp. nov.

Somewhat woody below, branching at base; branches angled, glabrous; petioles usually hairy; leaflets three, glabrous throughout or slightly ciliate, orbicular to narrowly oblong, obtuse or slightly retuse, the upper leaflet somewhat remote; peduncles 2 to 2.5 cm. long, longer than the petioles; flowers in umbels of 3 or 4; buds ovate, acute; sepals ovate, 5 mm. long, acute, glabrous or nearly so; petals yellow; capsule oblong, 6 to 8 mm. long, smooth; cells 3-seeded.

Type U. S. National Herbarium no. 302240, collected by J. N. Rose on road between Rosario and Concepción, Sinaloa, July 27, 1897 (no. 3265).

Lotoxalis pentantha (Jacq.) Rose.
Oxalis pentantha, Jacq. Oxal. 21. *pl. 1.* 1794.

Lotoxalis psilotricha (Turcz.) Rose.
Oxalis psilotricha Turcz. Bull. Soc. Nat. Mosc. **31**^{1}: 428. 1858.

Lotoxalis tephrodes (Turcz.) Rose.
Oxalis tephrodes Turcz. Bull. Soc. Nat. Mosc. **31**: 428. 1858.

Lotoxalis yucatanensis Rose, sp. nov.

Ten to 30 cm. high, erect, woody throughout; young parts with ascending somewhat appressed pubescence; leaflets 3, the terminal remote, oblong to orbicular, thin (in herbarium specimens), mostly rounded at base, usually strongly emarginate, but the tips unequal, nearly glabrous, 5 to 15 mm. long; inflorescence of 5 to 7 flowers, dichotomous with central flower solitary, compact, the pedicels jointed above the base; sepals ovate, obtuse, 3 mm. long, nerved, glabrous or nearly so; corolla yellow; 5 longer filaments hairy; capsule orbicular(?), glabrous on the angles.

Type U. S. National Herbarium no. 268419 (Gaumer no. 715).

Specimens examined:

Yucatan, Schott, 1865 (no. 625); G. F. Gaumer, 1895 (no. 715); C. F. Millspaugh, 1899 (no. 1633).

This species has heretofore passed under the name of *L. berlandieri*, but differs in its more erect shrubby habit and glabrous capsules, in the character of its inflorescence, etc. It is apparently confined to Yucatan.

RESTORATION OF BIOPHYTUM.[a]

This genus was established by DeCandolle in 1824, based upon two species formerly referred to Oxalis. It was shortly afterwards returned to Oxalis where it remained for the next half-century. Gardeners, however, usually kept it out of Oxalis on account of its very peculiar habit. Don and Nickelson both recognize Biophytum. Durand takes it up in 1888 and so does R. Reeche in Engler and Prantl's late work.

Otto Kuntze takes up for this genus the pre-Linnaean name Toddavaddi (1742).

About twenty species have been recognized, but only the following is known to grow in Mexico.

Biophytum dendroides (H. B. K.) DC. Prod. **1**: 690. 1824.
Oxalis dendroides H. B. K. Nov. Gen. & Sp. **5**: 250. 1823.
Toddavaddi dendroides Kuntze, Rev. Gen. Pl. **1**: 96. 1891.

Specimen examined:

Vera Cruz: Barranca of Chavarreillo, C. G. Pringle, 1899 (no. 8165).

PSEUDOXALIS, A NEW GENUS.

Pseudoxalis gen. nov.

Probably perennial, caulescent from slender running rootstocks; leaves alternate; stipules wanting; leaflets 3, palmate, sessile; peduncles 1 or 2-flowered; sepals 5, broad, thin, petaloid, much longer than the petals; petals small, yellow.

Perhaps nearest Xanthoxalis, from which it differs especially in its small corolla and large petaloid sepals. When *Oxalis madrensis* was first described it was compared by Doctor Watson with *O.* (now *Lotoxalis*) *berlandieri*, from which it differs especially in its foliage.

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[a] BIOPHYTUM DC. Prod. **1**: 689. 1824.

P. madrensis (S. Wats.) Rose.

Oxalis madrensis S. Wats. Proc. Am. Acad. **25**: 144. 1890.

Stems much branched, creeping, pubescent; leaflets obovate, obtuse or retuse, 10 to 12 mm. long; sepals obtuse, 6 to 8 mm. long.

Only known from mountains near Monterey, Nuevo Leon. Collected by C. G. Pringle, July 16, 1889 (no. 2867).

LINACEAE.

TWO NEW SPECIES OF LINUM.

Linum longipes Rose, sp. nov.

Annual, erect, 20 to 30 cm. high, simple below, branching above, slightly hairy; lower leaves in whorls, oblong to obovate, 10 to 15 mm. long, obtuse, shortly but distinctly petioled, very thin; upper leaves attenuate, acute, stipular glands wanting; pedicels slender, 10 to 20 mm. long; sepals 2 to 2.5 mm. long, ovate, acuminate, slightly glandular-ciliate; petals yellow, about twice as long as the sepals; styles slender united, nearly to the top, valves 10; carpels small, without cartilaginous insertions at base.

Type U. S. National Herbarium no. 381811, collected by C. G. Pringle, in mountains near Iguala, Guerrero, October 11, 1900 (no. 9261).

This species resembles somewhat *L. cruciatum*, but has the styles united, the pedicels longer and glabrous, etc.

Linum nelsoni Rose, sp. nov.

Perennial, much branched at base, the branches long, often weak, perhaps sometimes procumbent, when young pilose; lower leaves in whorls, oblong, 10 to 15 mm. long, obtuse, at first pilose, becoming glabrate, the uppermost leaves alternate, acute; inflorescence open; pedicels pilose; sepals ovate, acute; petals yellow, 5 to 6 mm. long; capsule 10-valved.

Type U. S. National Herbarium no. 469215, collected by E. W. Nelson at Boca del Monte, Vera Cruz, March 13, 1894 (no. 210). Also collected by C. A. Purpus, on Ixtaccíhuatl, January, 1903 (no. 67).

BALSAMEACEAE.

RESTORATION OF TEREBINTHUS, WITH ITS SPECIES.

The ancient name Terebinthus was adopted by Tournefort, Ray, and other well-known authors, but was discarded by Linnaeus for Pistacia, a name almost, if not quite, equally ancient. In accordance with the present practice in nomenclature Pistacia must remain the name of the genus to which Linnaeus applied it. Mr. William F. Wight has called my attention to the fact that the name Terebinthus, however, is valid for another genus, that to which it was first applied by a post-Linnaean author. This first use was by Patrick Browne in 1756,[a] who based his genus on a single species, *Pistacia simaruba* L., which will therefore be the type of Terebinthus.[b] Although the Linnaean binomial is not given by Browne, the three following references, "Pistacia foliis pinnatis deciduis, foliolis ovatis. L. Sp. Pl. Terebenthus major Betulae cortice, etc. Slo. Cat. 167 & H. Simaruba. L. M. Med.", unmistakably establish the identity of Browne's species with *Pistacia simaruba*, as the same references with no other description or citation, are given by Linnaeus for this species. Four years after the publication of Browne's work, Jacquin, 1760,[a] includes the same species as *Terebinthus brownii.* Linnaeus in 1762,[b] changed the name to *Bursera gummifera.* This name, modified in spelling to *Burseria gummifera*, was adopted by Jacquin 1763.[c] But Bursera or Burseria, is invalid for this genus not only because it is antedated by Terebinthus but because the name was applied earlier[d] to a different genus. Another name which has been used by some authors is Elaphrium, Jacquin 1760.[e] This is four years later than Browne's publication of Terebinthus and even the latter name has place priority in the same work in which Elaphrium appears.

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[a] Civil and Natural History of Jamaica, p. 345.

[b] For citation and synonymy see *Terebinthus simaruba* in list below.

The following are the known Mexican species:

Terebinthus aloexylon (Schiede) W. F. Wight.
Elaphrium aloexylon Schiede, Linnaea **17**: 252. 1843.

Terebinthus aptera (Ramirez) Rose.
Bursera aptera Ramirez, Anal. Inst. Med. Nac. **2**: 16. *pl. 1.* 1896.

Terebinthus arborea Rose, sp. nov.

Tall trees; old trunks red and smooth; young branches pubescent; leaflets 2 to 4 pairs, 4 to 9 cm. long, ovate, rounded or cuneate or rarely cordate at base, more or less abruptly acuminate, the acuminum obtuse, somewhat pubescent on both sides; inflorescence paniculate; fruit glabrous; sepals ovate, acute, ciliate; fruit in very compact clusters.

Type U. S. National Herbarium no. 302233 (Rose 3259e), collected by J. N. Rose between Acaponeta and Concepción, Tepic, July 2 (no. 1505), July 4 (no. 1530); near Rosario, July 22 (no. 1821); between Rosario and Concepción, July 27 (3259a and 3259e) and July 28 (3259b). All collected in 1897.

A very common tree in the low country of Tepic and Sinaloa.

Terebinthus arida Rose, sp. nov. PLATE XXXVI.

A low shrub; branches dark gray, those of the first year densely pubescent, the older ones glabrous; leaves clustered near the ends of short spurs or scattered along the new branches; leaflets mostly 2 to 4 pairs, rarely reduced to 3 or sometimes even to one, oblong to spatulate, 4 to 6 cm. long, obtuse, glabrous on both sides; petiole and the narrowly winged rachis slightly hairy; flowers subsessile; calyx half as long as petals, both hairy; fruit subsessile, glabrous.

Type U. S. National Herbarium no. 453480, collected by J. N. Rose and Jos. H. Painter near Tehuacán, Puebla, 1905 (no. 9985), August 1 and 2, 1901 (no. 5864), and by J. N. Rose, same locality,

This species must be near *B. galeotti*, but it has fewer and differently shaped leaflets, etc.

EXPLANATION OF PLATE XXXVI.—Fig. *a*, plant; *b*, fruit. Fig. *a*, natural size; *b*, enlarged.

Terebinthus bicolor (Schlecht.) Rose.
Elaphrium bicolor Schlecht. Linnaea **17**: 625. 1843.

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[a] Enum. Pl. Carib. 3, 18.

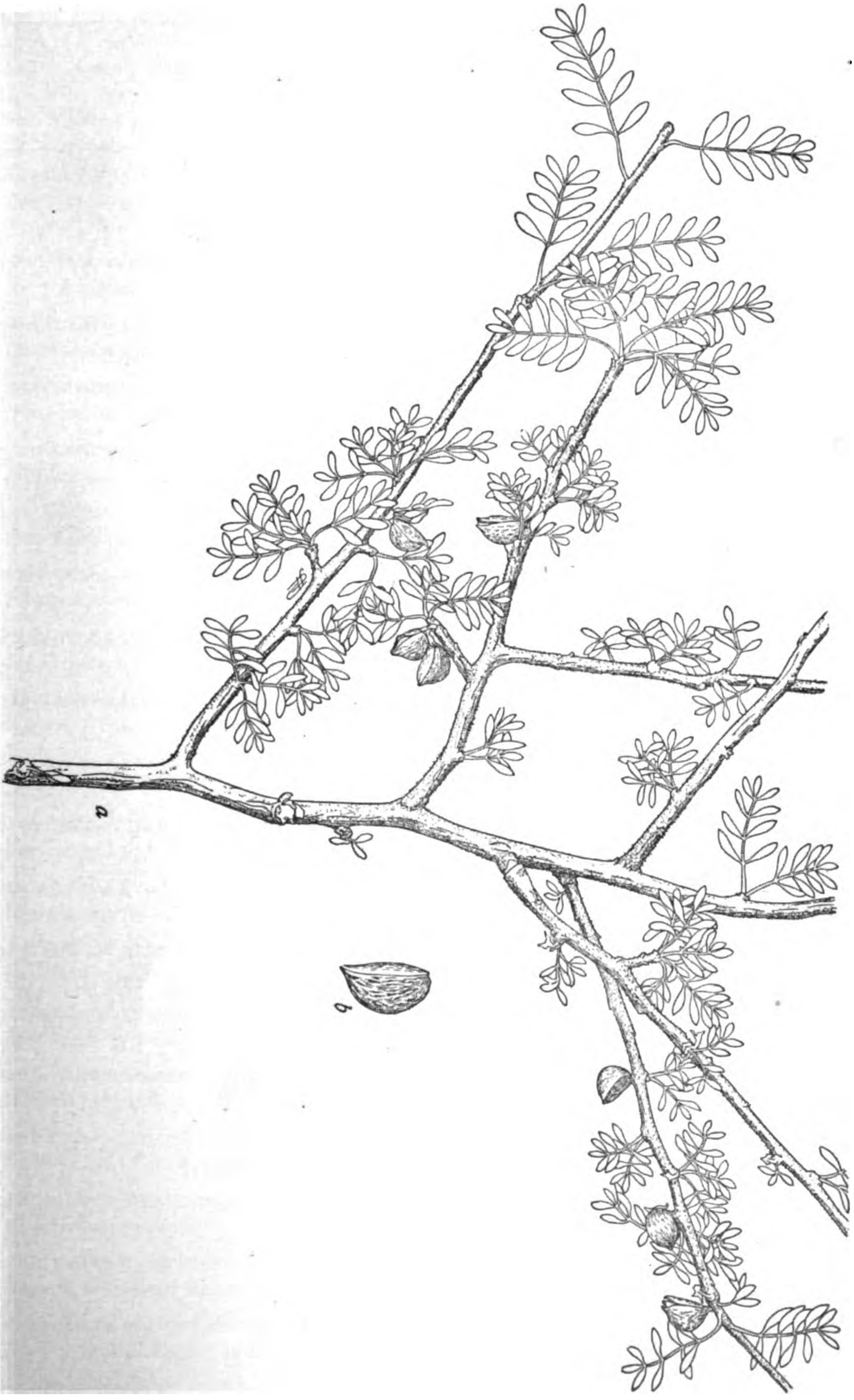
[b] Sp. Pl. ed. 2. **1**: 471.

[c] Stirp. Am. Hist. 94. *pl. 65.*

[d] Loefling, Iter. 194. 1758.

[e] Enum. Pl. Carib. 3, 19.

PLATE XXXVI.



TEREBINTHUS ARIDA ROSE.

Terebinthus biflora Rose, sp. nov.

Two to 5 meters high with many short stunted branches; leaves on very short petioles (8 mm. long); leaflets always 3, small (6 to 20 mm. long), ovate to obovate, acute or obtuse, more or less cuneate at base, crenate, slightly pubescent on both sides; fruiting peduncles slender, 12 to 20 mm. long; pedicels 4 mm. long; fruit usually in pairs, 8 mm. long, glabrous.

Type U. S. National Herbarium no. 316639, collected on limestone ledges near Tehuacán, Puebla, by C. G. Pringle, August 27, 1897 (no. 6686). Also collected at the same locality by J. N. Rose, August 2, 1901 (no. 5903).

Terebinthus bipinnata (DC.) W. F. Wight.
Amyris bipinnata DC. Prod. **2**: 82. 1825.

Terebinthus cerasifolia (Brandegee) Rose.
Bursera cerasifolia Brandegee, Proc. Cal. Acad. II. **3**: 121. 1891.

Terebinthus cinerea (Engler) Rose.
Bursera cinerea Engler, DC. Monog. Phan. **4**: 43. 1883.

Terebinthus cuneata (Schlecht.) Rose.
Elaphrium cuneatum Schlecht. Linnaea **17**: 629. 1843.

Terebinthus delpechiana (Poisson) Rose.
Bursera delpechiana Poisson; Engl. in DC. Monog. Phan. **4**: 53. 1883.

Terebinthus excelsa (H. B. K.) W. F. Wight.
Elaphrium excelsum H. B. K. Nov. Gen. & Sp. **7**: 30. *pl. 611*. 1825.

Terebinthus fagaroides (H. B. K.) W. F. Wight.
Elaphrium fagaroides H. B. K. Nov. Gen. & Sp. **7**: 27. 1825.

Terebinthus fragilis (S. Wats.) Rose.
Bursera fragilis S. Wats. Proc. Am. Acad. **21**: 442. 1886.

Terebinthus galeottiana (Engler) Rose.
Bursera galeottiana Engler in DC. Monog. Phan. **4**: 47. 1883.

Terebinthus glabrescens (S. Wats.) Rose.
Bursera palmeri glabrescens S. Wats. Proc. Am. Acad. **25**: 145. 1890.

Terebinthus gracilis (Engler) Rose.
Bursera gracilis Engler in DC. Monog. Phan. **4**: 50. 1883.

Terebinthus grandifolia (Engler) Rose.
Bursera grandifolia Engler in DC. Monog. Phan. **4**: 50. 1883.

Terebinthus graveolens (H. B. K.) Rose.
Elaphrium graveolens H. B. K. Nov. Gen. Sp. **7**: 31. 1825.

Terebinthus heterophylla (Engler) Rose.
Bursera heterophylla Engler in DC. Monog. Phan. **4**: 46. 1883.

Terebinthus jonesii Rose.
Bursera jonesii Rose, Contr. Nat. Herb. **3**: 314. 1895.

Terebinthus jorullensis (H. B. K.) W. F. Wight.
Elaphrium jorullense H. B. K. Nov. Gen. & Sp. **7**: 28. *pl. 612*. 1825.

Terebinthus karwinskii (Engler) Rose.
Bursera karwinskii Engler in DC. Monog. Phan. **4**: 57. 1883.

Terebinthus kerberi (Engler) Rose.
Bursera kerberi Engler in DC. Monog. Phan. **4**: 41. 1883.

Terebinthus lancifolia (Schlecht.) W. F. Wight.
Elaphrium lancifolium Schlecht. Linnaea **17**: 247. 1843.

Terebinthus lanuginosa (H. B. K.) Rose.
Elaphrium lanuginosum H. B. K. Nov. Gen. & Sp. **7**: 31. 1825.

Terebinthus longipes Rose, sp. nov.

A small tree 3 to 4 meters high, with a smooth trunk and with a broad flat top, glabrous throughout; leaves pinnate, 10 to 25 cm. long; common petiole terete, not at all winged between the leaflets; leaflets 3 to 6 pairs, on slender petiolules (the longer 10 mm. long) long-acuminate, the terminal ones cuneate at base, the others usually rounded, sometimes narrowed, always more or less oblique at base, green above, paler and somewhat reticulated below, quite glabrous on both sides even when quite young; inflorescence paniculate, 10 cm. long; flowering pedicels 4 to 5 mm. long, in fruiting 5 to 8 mm. long; sepals ovate, obtuse; petals white, oblong, 3 mm. long; fruit oblong, 12 mm. long, borne in a dense cluster.

Type U. S. National Herbarium no. 346674, collected by J. N. Rose and Walter Hough on the dry hills above Matamoras, Puebla, June 26, 1899 (no. 4691). Also collected by C. G. Pringle near Jojutla, Morelos, 1901 (no. 8510).

This species was not common about Matamoras, but was found scattered along the brow of dry hills mingled with various species of Acacia, Mimosa, and Opuntia.

The type (Rose's no. 4691) is a fruiting specimen. The flower characters are drawn from Pringle's no. 8510, which apparently belongs here, although the leaves are very immature. This species, while related to *T. simaruba*, is very different in its habit of growth, inflorescence, foliage, etc.

Terebinthus macdougali Rose, Torreya **6**: 170. August, 1906.

A small tree; bark of 1 and 2 year old branches reddish, smooth; leaves clustered at the ends of short spurs, either simple or with 3 to 5 leaflets; rachis of compound leaves winged; petioles short; blade oblong, obtuse, 1 to 1.5 cm. long, crenately toothed, with a very short, dense pubescence on both surfaces; male flowers borne in short racemes or panicles; sepals and petals densely pubescent; female flowers solitary; peduncles very short, 4 mm. long, glabrous.

A species common on the hills near the head of the Gulf of California, first collected by Dr. E. Palmer in 1870 and recently collected near the same region by Dr. D. T. MacDougal, after whom I take great pleasure in naming it.

This has heretofore been confused with *B. hindsiana* of southern Lower California, from which, however, it seems quite distinct. It differs in its more vigorous branches, reddish instead of blackish bark on 1 and 2 year old shoots, somewhat thicker leaves and leaflets, shorter and denser pubescence on leaves, more pubescent petals, etc.

Type U. S. National Herbarium no. 15501, collected by Dr. E. Palmer.

Specimens examined:

Lower California: Exact locality not given but doubtless near the mouth of the Colorado River, Dr. E. Palmer; San Felipe Bay, D. T. MacDougal, February, 1904; Los Angeles Bay, Dr. E. Palmer, 1887 (no. 572).

Sonora: Hills near the Gulf of California, C. G. Pringle, August 20, 1884.

Terebinthus mexicana (Engler) W. F. Wight.
Bursera mexicana Engler, DC. Monog. Phan. **4**: 51. 1883.

Terebinthus microphylla (A. Gray) Rose.
Bursera microphylla A. Gray, Proc. Am. Acad. **5**: 155. 1861.

Terebinthus morelensis (Ramirez) Rose.
Bursera morelensis Ramirez, Anal. Inst. Med. Nat. **2**: 17. 1896.

Terebinthus multifolia Rose, sp. nov.

Small shrub 2.4 meters high; branches dark, sometimes reddish, glabrous; very young branches puberulent; leaves borne in clusters near the ends of short branches, once pinnate; leaflets 15 to 19, linear-oblong, 10 to 13 mm. long, 2 to 3 mm. broad, glabrous, entire, obtuse; fruit solitary on short reflexed peduncles, orbicular, glabrous, 3 lines long.

Type U. S. National Herbarium no. 301368, collected by J. N. Rose at San Juan Capistrano, Zacatecas, August 21, 1897 (no. 2455).

This species is nearest *T. microphylla* (A. Gray) Rose and *T. morelensis* (Ramirez) Rose, from both of which it differs in its more distinct leaflets, shorter peduncles, etc.

Terebinthus multijuga (Engler) Rose.

Bursera multijuga Engler in DC. Monog. Phan. **4**: 42. 1883.

Terebinthus odorata (Brandegee) Rose.

Bursera odorata Brandegee, Proc. Cal. Acad. II. **2**: 138. 1889.

Mr. Brandegee reduced this species to *B. fagaroides*, but a study of good material recently collected by Nelson and Goldman convinces me that while its relationship is evidently here it is clearly distinct.

Terebinthus ovalifolia (Schlecht.) Rose.

Elaphrium ovalifolium Schlecht. Linnaea **17**: 248. 1843.

Terebinthus palmeri (S. Wats.) Rose.

Bursera palmeri S. Wats. Proc. Am. Acad. **22**: 402. 1886.

Terebinthus pannosa (Engler) Rose.

Bursera pannosa Engler in DC. Monog. Phan. **4**: 54. 1883.

Terebinthus penicillata (DC.) Rose.

Elaphrium penicillatum DC. Prod. **1**: 724. 1824.

Terebinthus pringlei (S. Wats.) Rose.

Bursera pringlei S. Wats. Proc. Am. Acad. **25**: 145. 1890.

Terebinthus rhoifolia (Benth.) Rose.

Elaphrium rhoifolium Benth. Bot. Sulph. 11. *pl. 7*. 1844.

Bursera hindseana rhoifolia Engler in DC. Monog. Phan. **4**: 59. 1883.

Elaphrium hindseanum Benth. op. cit. *pl. 8*.

In 1844 Bentham described from the Bay of Magdalena two species of Bursera under the names *Elaphrium rhoifolium* and *E. hindseanum* differing, as he states, only in the number of leaflets, the former having 3 and the latter only 1. Dr. Engler in his Monograph of the Burseraceae has reduced *rhoifolia* to a variety of *hindseana* although the name *rhoifolia* has precedence by position. There appears to be no ground for maintaining both species and very little to support a subspecies. *Rhoifolia* should therefore be the name of the species and *hindseana* should either be consigned to synonomy or taken up for a subspecies if there proves to be one. Mr. Brandegee, who has visited the type locality, states that the number of leaflets varies from 1 to 9 and he is therefore of the opinion that no variety should be retained, with which opinion I am in accord.

Terebinthus rubra Rose, sp. nov.

Small trees or shrubs with smooth red trunks, the bark peeling off in broad sheets; young branches and leaves glabrous; leaflets 5 to 7 pairs, lanceolate, rounded at base, acuminate, serrate below, entire above, paler beneath, 4 cm. long or less; flowers not seen, but inflorescence apparently open; fruiting peduncle 1 to 2 cm. long, bearing two to four fruits; fruit obovate, somewhat 3-angled.

Only seen in southeastern Sinaloa in the foothills, where it seems to be common growing with *T. tenuifolia*.

Type U. S. National Herbarium 300526, collected by J. N. Rose near Colomas, Sinaloa, July 14, 1897 (no. 1670).

This species seems nearest *T. pringlei* but has shorter petioles and peduncle and much broader leaflets, etc.

Terebinthus schaffneri (S. Wats.) Rose.
Bursera schaffneri S. Wats. Proc. Am. Acad. **22**: 469. 1887.

Terebinthus schiedeana (Engler) Rose.
Bursera schiedeana Engler in DC. Monog. Phan. **4**: 57. 1883.

Terebinthus schlechtendalii (Engler) Rose.
Bursera schlechtendalii Engler in DC. Monog. Phan. **4**: 54. 1883.

Terebinthus sessiliflora (Engler) Rose.
Bursera sessiliflora Engler in DC. Monog. Phan. **4**: 55. 1883.

Terebinthus simaruba (L.) W. F. Wight.
Pistacia simaruba L. Sp. Pl. **2**: 1026. 1753.
Terebinthus brownii Jacq. Enum. Pl. Carib. 18. 1760.
Bursera gummifera L. Sp. Pl. ed. 2. **1**: 471. 1762.

Terebinthus submoniliformis (Engler) Rose.
Bursera submoniliformis Engler in DC. Monog. Phan. **4**: 55. 1883.

Terebinthus subtrifoliata Rose, sp. nov.

Low shrub, glabrous throughout; branches dark; leaves simple or trifoliate, cuneate at base, rounded at apex, crenate, glabrous on both sides, 25 mm. or less long; flowers one to three in the axils of the leaves; pedicels short (2 to 3 mm. long) reflexed in fruit; fruit somewhat 3-angled, glabrous, 3 mm. long.

Type U. S. National Herbarium no. 301971, collected by J. N. Rose west of Bolaños, Jalisco, September 17, 1897 (no. 3014).

Resembling somewhat *T. rhoifolia* in its variable leaflets, but they are not pubescent as in that species.

Terebinthus tenuifolia Rose.
Bursera tenuifolia Rose, Contr. Nat. Herb. **3**: 314. 1895.

TEREBINTHUS TOMENTOSA (Jacq.) W. F. Wight. *Elaphrium tomentosum* Jacq. Enum. Pl. Carib. 19. 1760. This is a South American species which may here be conveniently transferred.

POLYGALACEAE.

THREE NEW SPECIES OF POLYGALA.

Polygala calcicola Rose, sp. nov. PLATE XXXVII.

Perennial, somewhat woody at base, much branched and diffuse, 10 cm. or less high, with appressed cinereous pubescence; leaves all alternate, linear to oblong, 10 to 15 mm. long, acute, with appressed pubescence on both sides; flowers either solitary or 3 to 5 in a short raceme; 3 outer sepals lanceolate, acute, pubescent; wings oblanceolate, 5 mm. long, pubescent, cream-colored; fruit orbicular to shortly oblong, 8 to 8.5 mm. long, glabrous except on the margin.

Type U. S. National Herbarium 316730, collected by C. G. Pringle on limestone hills near Tehuacán, Puebla, August 7, 1897 (no. 7477).

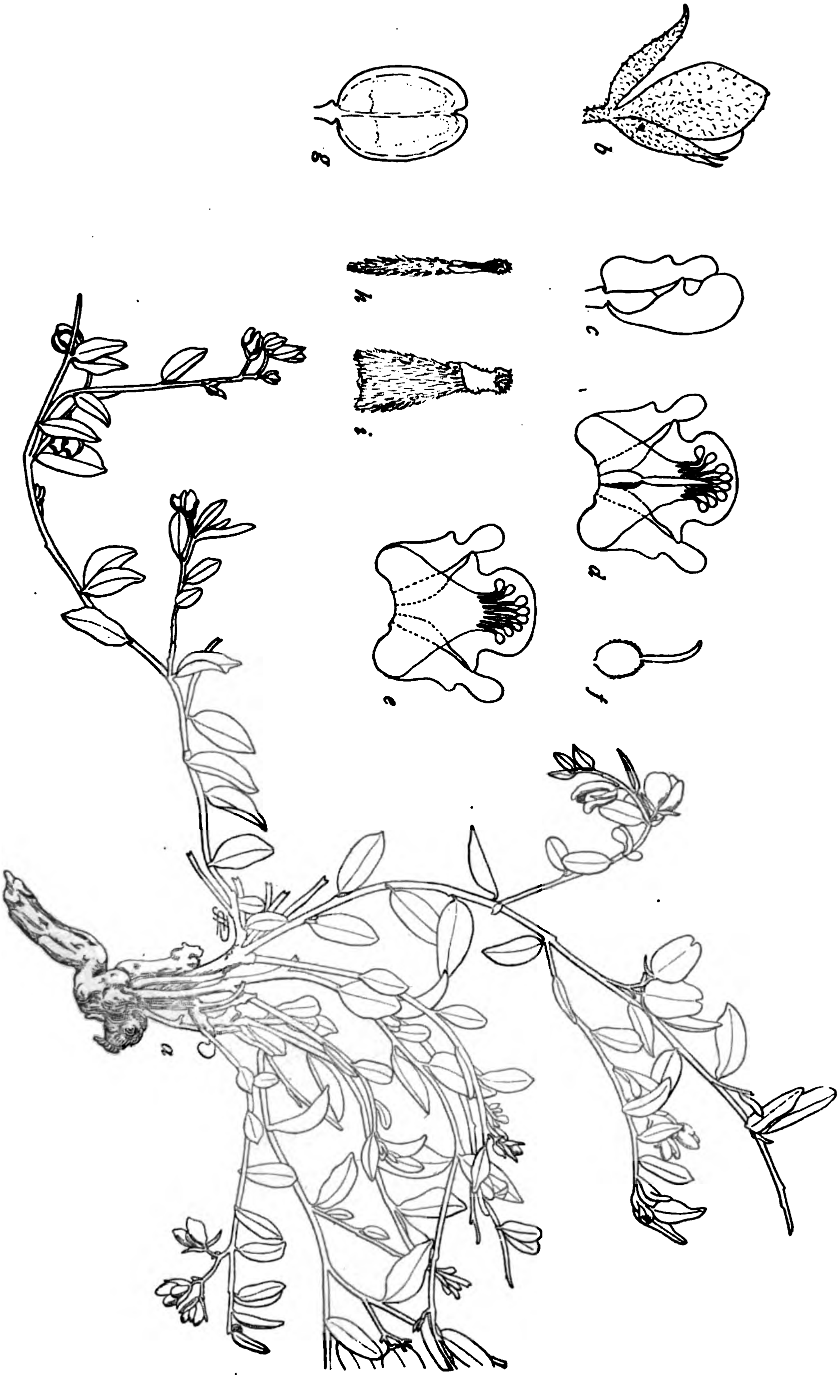
Perhaps nearest *P. ovalifolia*, but with the pubescence appressed and the sepals more persistent, etc.

EXPLANATION OF PLATE XXXVII.—Fig. *a*, plant; *b*, calyx; *c*, petals; *d*, petals, stamens, and pistil; *f*, pistil; *g*, ovary; *h* and *i*, two views of seed. Fig. *a*, natural size; *b* to *i*, scale 4.

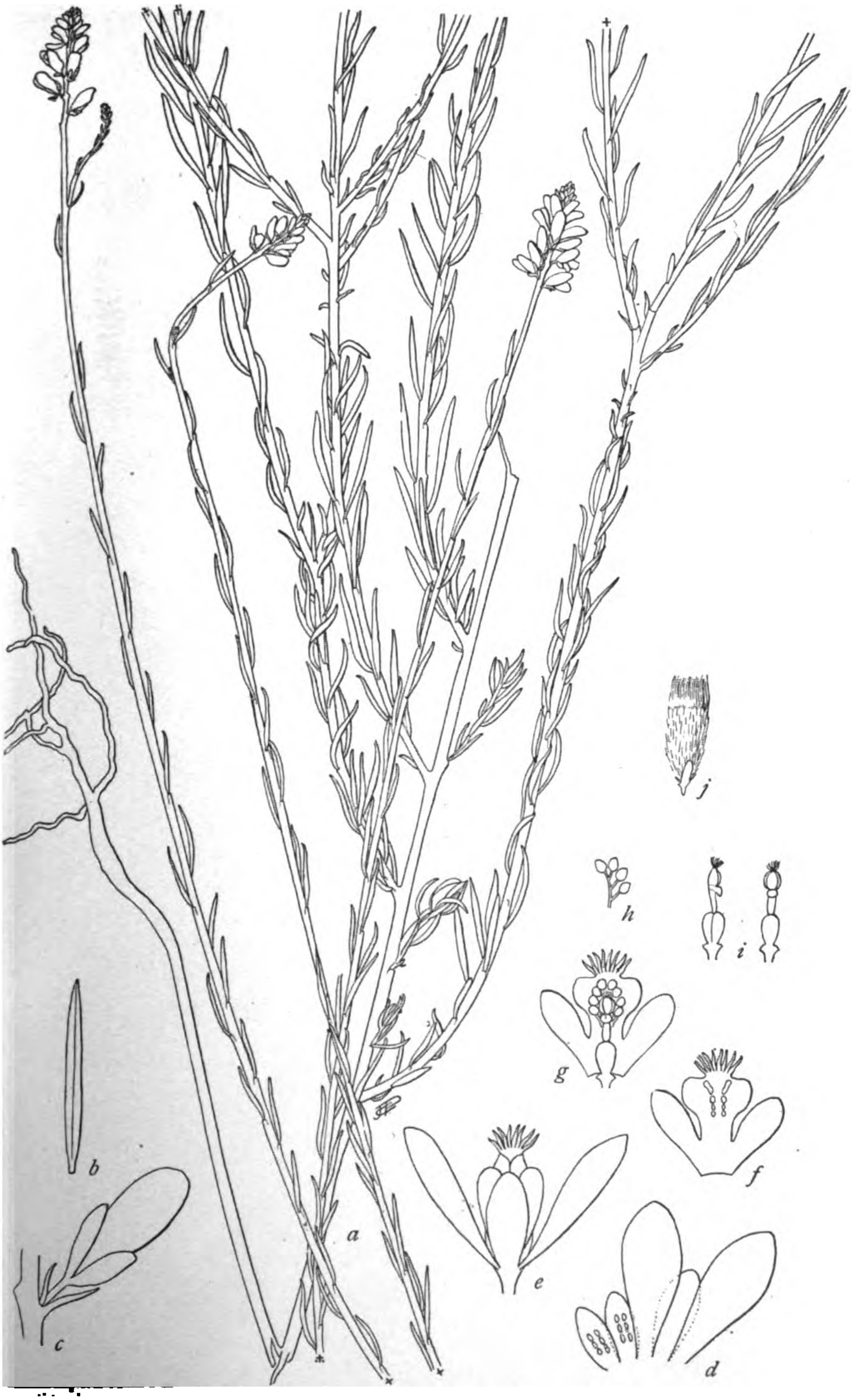
Polygala nelsoni Rose, sp. nov. PLATE XXXVIII.

Stems annual, 30 to 40 cm. high, simple below, somewhat branched above, glabrous; upper leaves and probably lower ones all alternate, linear, 8 to 12 mm. long, glabrous and glandular, acute; inflorescence a short spike-like raceme; bracts caducous; 3 outer sepals shortly oblong, obtuse; wings spatulate, reddish; upper petal crested; seeds with appendages at base, very hairy.

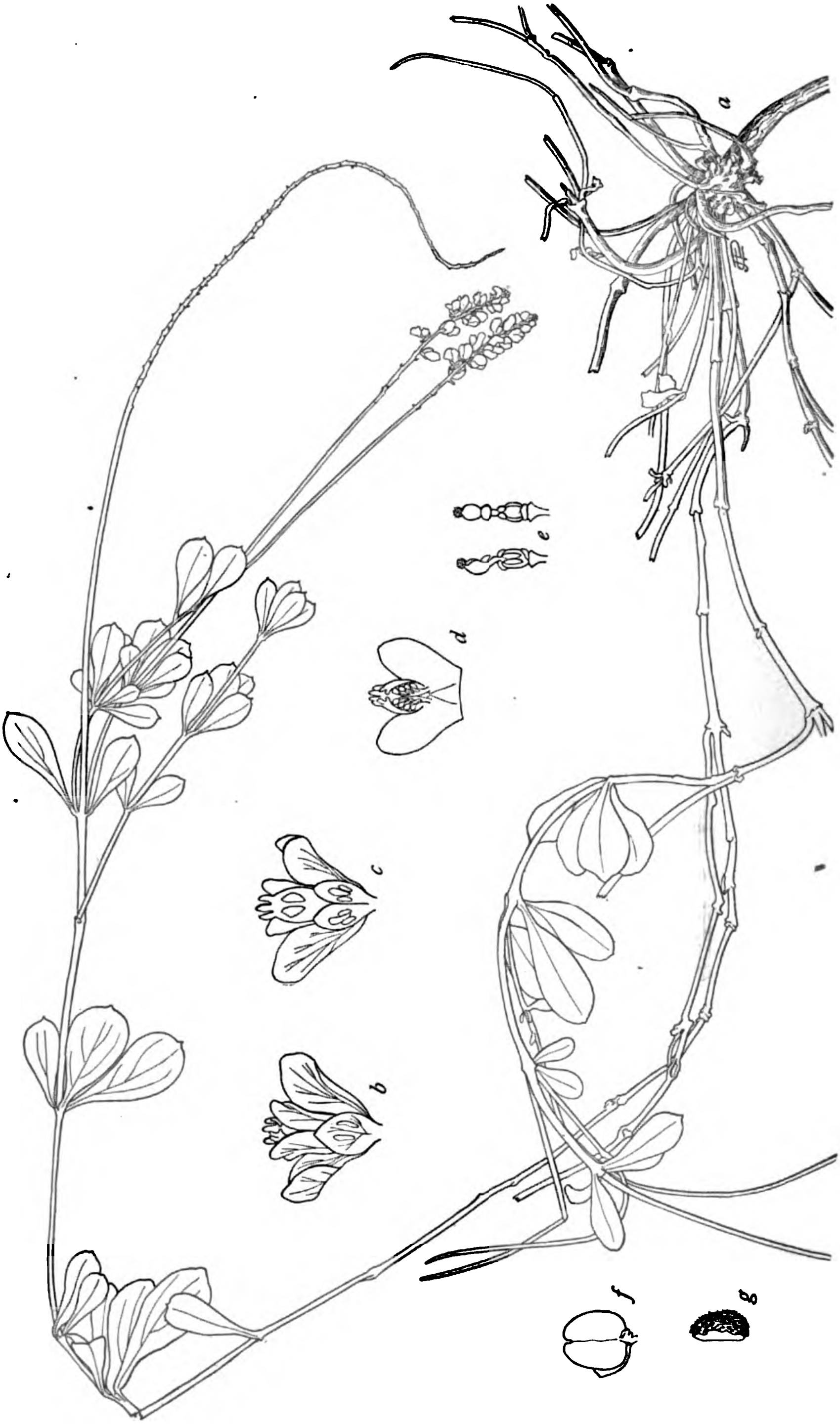
PLATE XXXVII.



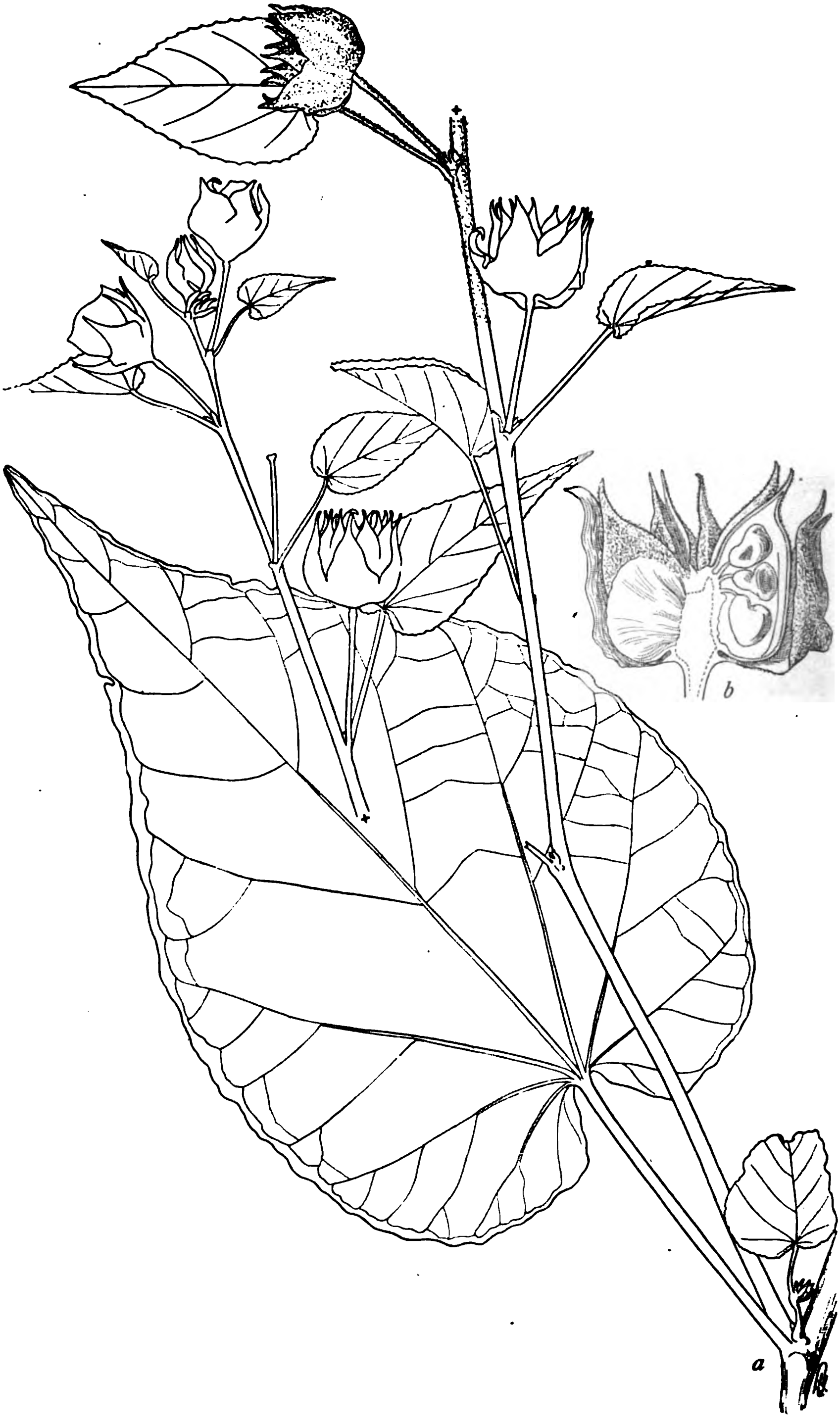
POLYGALA CALCICOLA ROSE.



POLYGALA NELSONI ROSE.



POLYGALA TURGIDA ROSE.



ABUTILON DURANGENSE ROSE & YORK.

Type U. S. National Herbarium no. 469216, collected by E. W. Nelson on road between Guichocovi and Lagunas, Oaxaca, June 29, 1895 (no. 2753).

This species is related to *P. paniculata* and *P. longicaulis*.

EXPLANATION OF PLATE XXXVIII.—Fig. *a*, plant; *b*, leaf; *c*, calyx; *d*, sepals; *e*, sepals and petals; *f*, petals; *g*, petals and stamens; *h*, stamens; *i*, two views of pistil; *j*, seed. Fig. *a*, natural size; *b* to *j*, scale 6.

Polygala turgida Rose, sp. nov. PLATE XXXIX. ✓

Perennial, prostrate, much branched, forming dense mats; stems terete, glabrous as are also the leaves and inflorescence; leaves all in whorls, apparently fleshy when alive, obovate, rounded at apex, sometimes mucronate, 15 to 25 mm. long; peduncles slender, weak, 2 to 6 cm. long; inflorescence a spike-like raceme, much elongated in fruit; pedicels short, subtended by small ovate scarious bracts and bearing at their base two small triangular bractlets; 3 outer sepals ovate, scarious-margined; wings much larger than the outer sepals; upper petal crested; capsule glabrous, orbicular, bearing at base a cushion-like disk; seeds hairy, aril scarious, as long as the seed. ?

Type U. S. National Herbarium no. 8215, collected by C. G. Pringle in alkaline meadows on the Hacienda de Angostura, San Luis Potosí, July 14, 1891 (no. 3792); also collected by Dr. E. Palmer at Media Luna near Rio Verde, San Luis Potosí, June, 1904 (no. 84).

Mr. Pringle's specimen was sent out as a doubtful *P. aparinoides*, but that is a very different species.

EXPLANATION OF PLATE XXXIX.—Fig. *a*, plant; *b* and *c*, flower; *d*, petals and stamens; *e*, two views of pistil; *f*, capsule; *g*, seed. Fig. *a*, natural size; *b* to *g*, scale 6.

MALVACEAE.

ABUTILON, A NEW SPECIES AND A NEW NAME.

Abutilon durangense Rose & York. PLATE XL.

Perennial; stems woody, dark purple, branching, covered with short glandular hairs; leaf blades ovate, 6 to 12 cm. long; 4 to 7 cm. wide, cordate at base (with a wide sinus), long-acuminate, finely dentate or crenate, or almost entire, the under surface pale in color, densely softly stellate-pubescent, the upper surface sparingly stellate with additional simple hairs, the veins purplish; petioles 2.5 to 4.5 cm. long, with glandular pubescence; stipules small, linear, deciduous; inflorescence paniculate, flowers axillary, solitary; peduncles 1.5 to 3 cm. long, jointed near apex; calyx 10 mm. long in fruit, finely and densely stellate, the lobes broadly ovate, long-acuminate, equaling or slightly longer than the mature carpels; petals yellow, obovate, 15 to 18 mm. in length; stamen tube very short; carpels 9, shortly acuminate, about 11 mm. in length, 2 or 3-seeded; seeds puberulent.

Type U. S. National Herbarium no. 304839, collected near Durango City, by Dr. E. Palmer, 1896 (no. 587).

EXPLANATION OF PLATE XL.—Fig. *a*, branch; *b*, carpels. Fig. *a*, natural size; *b*, scale 2.

Abutilon hemsleyana Rose.

Abutilon sidoides Hemsley, Diag. Pl. Nov. 2: 24. 1879, not Dalz. & Gibs. 1861.

TWO NEW SPECIES OF WISSADULA.

Wissadula glandulosa Rose, sp. nov.

Woody at base, the branches spreading or procumbent, very glandular; leaves broadly ovate, acute, cordate at base, stellate-pubescent, crenate, the petiole often longer than the blade; stipules filiform; fruiting calyx 12 to 14 mm. long; sepals broadly ovate, acuminate; petals yellow, 15 to 16 mm. long; carpels 5, strongly mucronate, each 3-seeded.

Type U. S. National Herbarium no. 9809, collected by J. N. Rose and Jos. H. Painter on the road between Higuerillas and San Pablo, Querétaro, August 24, 1905 (no. 9809).

Perhaps nearest *W. pringlei*, but leaves not acuminate, stem less pilose, plant more glandular, etc.

Wissadula lozani Rose, sp. nov. PLATE XLI.

Branches terete, covered with stellate hairs; upper leaves oblong, 5 to 7 cm. long, at most acute, truncate or slightly cordate at base, crenate; inflorescence paniculate; pedicels short (10 mm. or less long), stout; fruiting calyx 10 to 12 mm. long; sepals ovate, acute; petals yellow; carpels 5, each 3-seeded.

Type U. S. National Herbarium no. 461976, collected by C. G. Pringle and F. Lozano at Hacienda El Carrizo near San Juan, Nuevo Leon (no. 13443).

This species belongs to the Abutilastrum section of the genus and is not closely allied to any of the six other described species of this group.

EXPLANATION OF PLATE XLI.—Fig. *a*, plant; *b*, calyx; *c*, corolla; *d*, carpels; *e*, section through carpels. Fig. *a*, natural size; figs. *b*, *c*, *d* and *e*, scale 2.

HYPERICACEAE.

FOUR NEW ST. JOHNSWORTS.

Hypericum confusum Rose, sp. nov.

Perennial, sending up a cluster of 3 to many herbaceous stems, 2.5 to 7.5 cm. high, sometimes 4-angled, glabrous; leaves sessile, oblong, with a short obtuse-tipped apex, either shorter or longer than the internodes, light green above, hardly paler beneath, 4 to 12 mm. long, 2 to 5 mm. wide; sepals somewhat unequal, 4 to 6 mm. long, acute; petals yellow; ovary shorter than the calyx; styles 3, somewhat elongated.

Type U. S. National Herbarium no. 304028, collected by Dr. C. G. Pringle in damp soil, Serrania de Ajusco, Distrito Federal, August 23, 1896 (no. 6440).

This species must be near the South American *H. brevistylum* with which it has been confused, but it has a less spreading habit, larger leaves, calyx, and flowers, longer styles, etc.

Hypericum diffusum Rose, sp. nov.

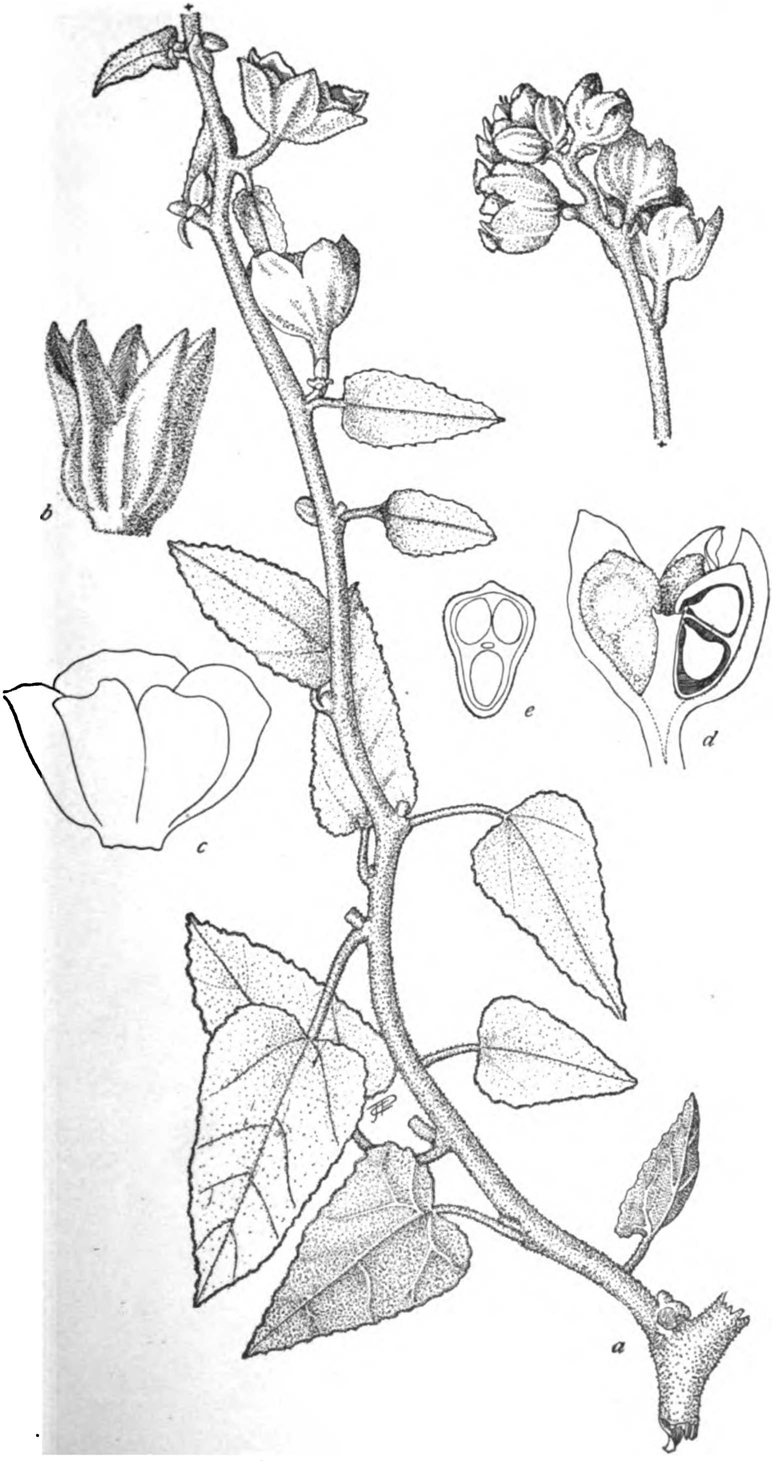
Perennial, usually branching at base; stems ascending, 10 to 12 cm. high, somewhat 4-angled; leaves lanceolate, acute, 10 to 16 mm. long, 4 to 7 mm. broad, 1-nerved, the margin somewhat scarious and slightly denticulate; flowers rather few; sepals lanceolate, 3-nerved, acute, 5 to 6 mm. long; petals yellow, longer than the sepals; stamens 9 to 15; capsule 1-celled, 6 to 7 mm. long; styles 3, distinct, each bearing a broad flat stigma.

Collected by C. G. Pringle in meadows near Buena Vista Station, Hidalgo, 1904 (no. 8802).

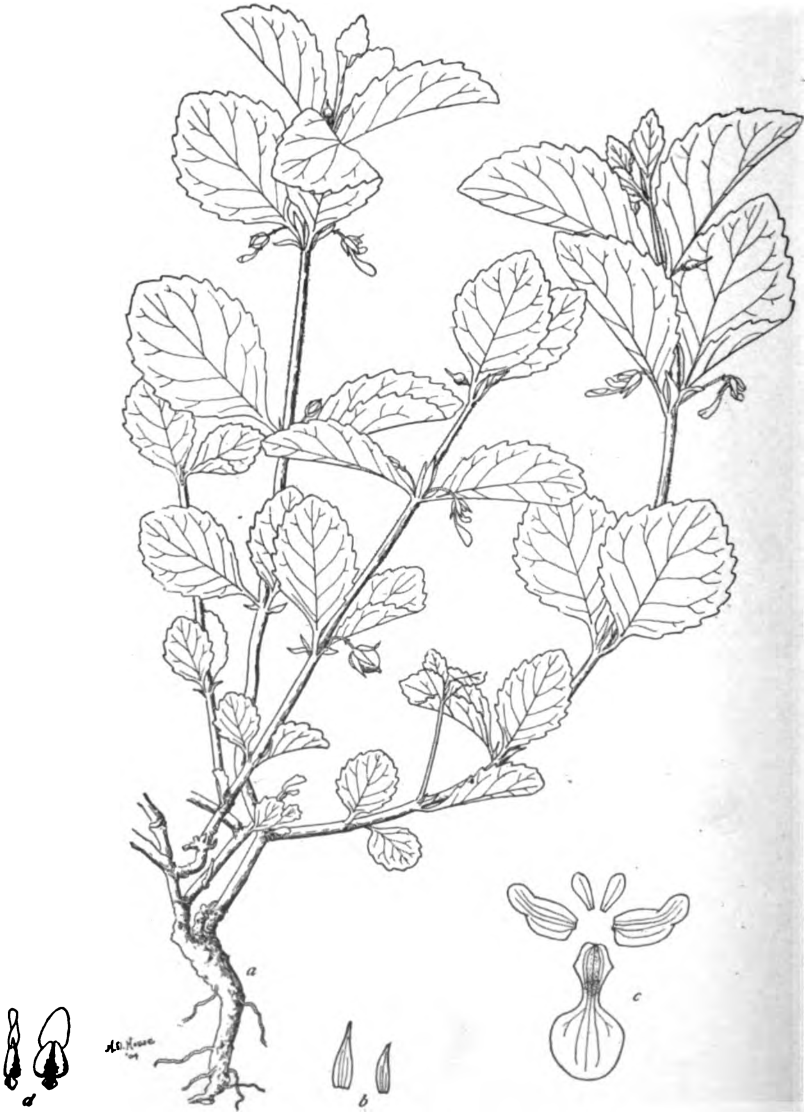
Hypericum simulans Rose, sp. nov.

Perennial; stem herbaceous, usually single, erect, 20 to 50 cm. high, glabrous; leaves oblong, 2 to 2.5 cm. long, obtuse, with many black dots on under surface; flowers few; bracts obtuse and leaf-like; sepals broadly ovate, 5 to 7 mm. long, obtuse, black-dotted; petals oblong, 10 to 12 mm. long, yellow or becoming reddish, more or less black-dotted on the margin; styles 3; capsule 3-celled.

Collected by C. G. Pringle, near Canales, Hidalgo, September, 1904 (no. 8993, type) and near Pachuca, Hidalgo, in 1903(?) (no. 6941); also in the latter locality by J. N. Rose, July 21 and 22, 1901 (no. 5572).



WISSADULA LOZANI ROSE.



CALCEOLARIA HUMILIS ROSE & DOWELL.

Hypericum submontanum Rose, sp. nov.

Stem much branched at base and often so above, 10 to 20 cm. high, only slightly angled; leaves decussate, lanceolate, obtuse, 10 to 12 mm. long, rather thin in texture, 1-nerved, with pellucid dots but never black ones; flowers very small; sepals linear, acute, 2 mm. or less long; petals 3 mm. or more long, drying reddish yellow; capsule 4 mm. long, 1-celled; styles 3, distinct, short, each capped by a broad flat stigma.

Type U. S. National Herbarium no. 304022, collected by C. G. Pringle in damp sandy meadows and lava fields on the Sierra de Ajusco, Distrito Federal, altitude 2,400 meters, October 3, 1896 (no. 6527); also collected by Mr. Pringle near the same locality, September 7, 1901 (no. 9357). This species was distributed as *H. philonotis* Schlecht. & Cham., from which, however, it must be very different.

VIOLACEAE.

A NEW CALCEOLARIA.

Calceolaria humilis Rose & Dowell, sp. nov. PLATE XLII.

Perennial, stem herbaceous, branching from the woody base, 10 to 20 cm. high, branches decumbent or ascending, pubescent in two lines; leaves opposite, short-petioled, 1 to 3 cm. long, 1 to 2 cm. wide, orbicular to ovate, acute or obtuse, glabrous, crenate-serrate, the blade decurrent on the ciliate petiole, this about 2 mm. long; stipules subulate to lanceolate and foliaceous, 4 to 8 mm. long, glabrous; flowers violaceous, nodding on slender, one-flowered, solitary, axillary peduncles; peduncles puberulent, 6 to 8 mm. long, the bracts opposite near the articulation; sepals lanceolate, acuminate, 3-nerved, glabrous, 4 mm. long; lip orbicular, slightly longer than its claw, 4 to 5 mm. long, the claw broadly winged, 5-nerved; lower stamens puberulent on the lower part of the connective above the gland-like appendages; capsule ovoid-globose, with a blunt beak, glabrous.

Collected by C. G. Pringle on lava fields near Tizapan, Valley of Mexico, altitude 2,300 meters, July 30, 1901 (no. 9653).

EXPLANATION OF PLATE XLII.—Fig. *a*, plant; *b*, sepals; *c*, petals; *d*, two views of stamens. Fig. *a*, scale ½; *b* and *c* natural size; *d*, scale about 2.

CACTACEAE.

ESCONTRIA, A NEW GENUS.

Escontria Rose, gen. nov.

Flowers small, tubular; ovary globular, covered with imbricating chartaceous, translucent, persistent scales, without spines or hairs; tube of flower narrow, also bearing scales like those of the ovary; petals erect, narrow, yellow; stamens and stipe included; fruit globular, scaly, purple, fleshy, edible; seeds black. Tree, very much branched; ribs of stems few.

This genus is segregated from Cereus on account of its small tubular flowers and scaly fruit. So far as I am aware the species upon which it is founded has no near relatives among the many described species of Cereus. Mr. G. N. Collins has photographed fruit of this or a closely related species at the Isthmus of Tehuantepec.

This genus is named for the late Señor Don Blas Escontría, who was Ministro de Fomento of Mexico at the time of his death, which occurred in January of this year. Señor Escontría was a man of high scientific attainments and took a great interest in all subjects relating to the scientific development of his country.

Escontria chiotilla (Weber) Rose. PLATE XLIII.

Cereus chiotilla Weber; Schumann, Ges. Kakteen 83. 1899.

From 4 to 7 meters high; trunk very short; branches very numerous, forming a very compact head, weak and easily broken, bright green, not at all glaucous; ribs 7 or 8, acute; areoles closely set, often running together, elliptical; radial spines 10 to 15, rather short, often reflexed; centrals several, one much longer, somewhat flattened, sometimes 7 cm. long, all light-colored; flowers borne near the ends of the branches, small, including the ovary about 3 cm. long; petals nearly erect, yellow; ovary and calyx tube covered with overlapping ovate, cartilaginous scales but without wool, spines, or hairs; fruit glabrous, about 5 cm. in diameter, edible, scaly.

The fruit is sold in the market at Tehuacán under the name of "geotilla" or "chiotilla" and as "tuna."

Very common at Tehuacan and Tomellín.

Specimens examined:

Puebla: Near Tehuacán, Rose & Painter, August 31, 1905 (no. 9939);

Oaxaca: Near Tomellín, Rose & Hough, June 23, 1899 (no. 4663); Rose & Painter, September 4, 1905 (no. 10107).

NEW SPECIES OF OPUNTIA AND ECHINOCACTUS.

Opuntia megarrhiza Rose, sp. nov.

Roots long (30 to 60 cm.) and very thick (5 to 6 cm. in diameter); stems low (20 to 30 cm. high), much branched at base; lower joints elongated, 20 to 30 cm. long, thin and pliable; lateral joints appearing along the margins of the older joints and often if not generally in the same plane; sepals small, ovate, reddish or rose-colored, acute and even apiculate; petals about 15, pale lemon or even rose-colored, 2 cm. long, obovate, mucronate-tipped; stamens short, numerous, erect; style longer than the stamens; stigmas about 7, greenish; ovary clavate, 3 cm. long, the areoles numerous, generally spineless but very woolly; umbilicus deep and broad; mature fruit not seen.

Type U. S. National Herbarium no. 570115, collected by Dr. E. Palmer near Alvarez, San Luis Potosí, May, 1905 (no. 607).

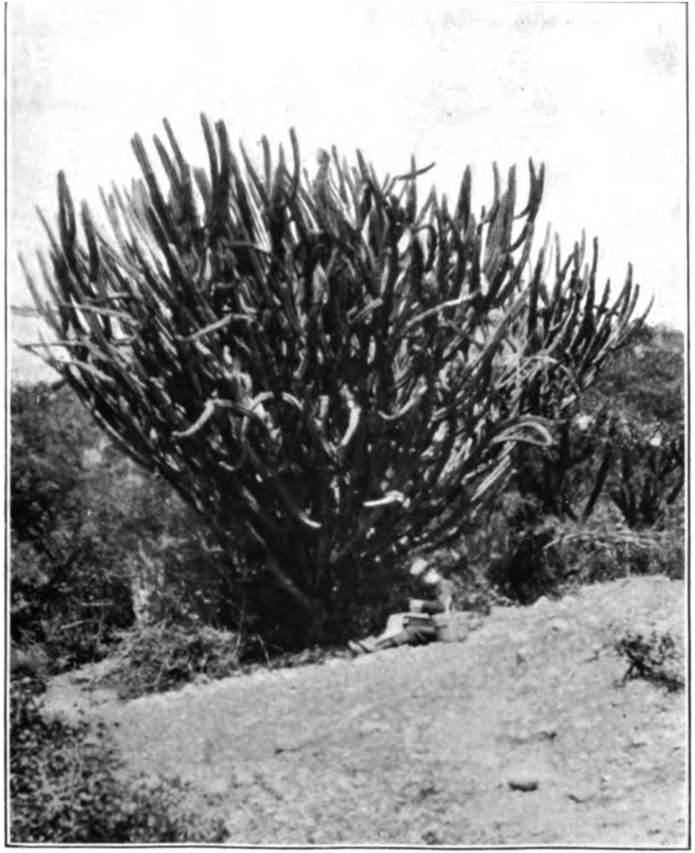
Echinocactus grandis Rose, sp. nov.

Cactus body 1 to 2 meters high, 60 to 100 cm. in diameter; ribs numerous (exact number not recorded), rather high, not undulate, bearing many closely set groups of spines; no distinct areole, but a continuous broad groove filled with felt-like hair in which are set the spines; radial spines 5 or 6 (10 specimens examined), about equal, 3 to 4 cm. long, straight and stiff, erect or slightly spreading; one very distinct central spine stouter and longer (4 to 5 cm. long) than the radial ones, distinctly banded as are some of the radial ones; all of the spines at first yellow, but the old ones becoming reddish brown; tops of flowering plants covered with dense white wool; flowers, including ovary, 4 to 5 cm. long, yellow; sepals lanceolate, tipped with a long mucro (almost spinescent), the margin more or less serrulate; petals somewhat similar but broader, obtuse at the apex and with a weaker mucro; fruit 5 to 6 cm. long, densely covered with long downy wool, tipped by the persistent flower, dry, many-seeded, the bracts few and spinescent; seeds blackish, smooth, shining.

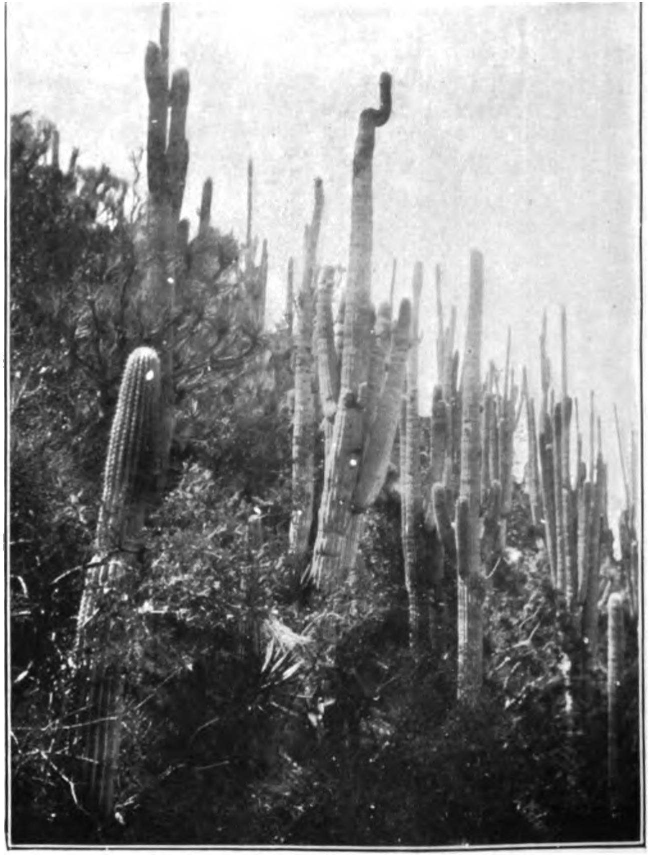
Very common on the limestone hills near Tehuacán, Puebla.

Type U. S. National Herbarium no. 461288, collected by C. G. Pringle in 1900 (no. 6696). Also collected by J. N. Rose, August 2, 1903 (no. 5953).

It is remarkable that this species has not heretofore been characterized, for it surely must have been frequently observed by collectors and travelers. It has probably been mistaken for some of the other large species such as *E. ingens*, *E. visnaga*, and *E. grusonii*, which, while they resemble it in a general way, still have very distinct characters.



A.—ESCONTRIA CHIOTILLA (WEBER) ROSE.



B.—CEPHALOCEREUS MACROCEPHALUS WEBER.

Echinocactus pringlei (Coulter) Rose.

Echinocactus pilosus pringlei Coulter, Contr. Nat. Herb. 3: 365. 1896.

This species is very distinct from the true *E. pilosus*. Both are under cultivation in Washington.

APIACEAE.

INTRODUCTORY NOTE.

In 1905 was published a supplement[a] to Coulter and Rose's Synopsis of the Mexican and Central American Umbelliferae. During the past year so many new species have been found and so much interesting material has come to hand that it seems best to publish the notes and descriptions.

ARRACACIA, NEW AND OLD SPECIES.

Arracacia aegopodioides Coulter & Rose.

Collected by J. N. Rose and Jos. H. Painter, in oak woods between Pachuca and Real del Monte, Hidalgo, July 19, 1905 (no. 8671); on Sierra de Pachuca, Hidalgo, July 20, 1905 (no. 8853); between Somoriel and Las Lajas, Hidalgo, August 5, 1905 (no. 9201).

Arracacia fruticosa Rose, sp. nov.

A meter or more high, the stem woody, at least often so, the herbaceous parts purplish and more or less glaucous, glabrous; basal and lower stem leaves ternately decompound, 30 to 40 cm. long, the ultimate segments small, ovate to lanceolate, sharply toothed or more or less cleft, glabrous; upper stem leaves much reduced; inflorescence much compounded, the rays often forming umbel-like clusters and these sometimes again compounded; rays 15 cm. or less long; involucre bracts and involucel bractlets wanting; but the top and base of the rays granulate; rays numerous, about equal, 3 to 4 cm. long; pedicels 3 mm. long; flowers deep purple; fruit 10 mm. long, smooth; carpels strongly 5-angled; seed deeply concave on the face; middle interval containing a single oil tube, the lateral intervals sometimes with two; carpophores broad and thin; stylopodia small but conical.

Type U. S. National Herbarium no. 453625, collected by J. N. Rose and J. H. Painter near the base of the red hills east of Tehuacán, Puebla, September 6, 1905 (no. 10125). In habit and especially in its frutescent stem this species resembles the genus Coulterophytum, but it has the fruit of a true Arracacia.

Arracacia multifida S. Wats.

Collected by J. N. Rose and Jos. H. Painter, near Tulancingo, Hidalgo, July 22, 1905 (no. 8834); on limestone hillside near Ixmiquilpan, Hidalgo, July 29, 1905 (no. 9048).

Arracacia tenuifolia Rose, sp. nov.

Stems 25 to 35 cm. tall, glabrous throughout, somewhat branched above, naked below; basal leaves large, ternately decompounded into linear, elongated, entire segments; peduncles slender, 8 to 10 cm. long; rays few (3 to 10), stout, 1 to 1.5 cm. long; involucel bractlets several, minute, shorter than the pedicels; pedicels short, 1 to 1.5 mm. long; fruit ovate, 4 mm. long; stylopodia slender-conical.

Type U. S. National Herbarium no. 453208, collected by J. N. Rose and Jos. H. Painter on a ledge of a high cliff near Cadereyta, Querétaro, August, 1905 (no. 9719). This species is near *A. multifida*, but has smaller and differently shaped fruit, etc.

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[a] Rose, Contr. Nat. Herb. 8: 331. 1905.

DEANEA, NEW AND OLD SPECIES.

Deanea arguta Rose, sp. nov.

Perennial, 50 to 60 cm. high, glabrous, slightly glaucous; basal leaves 2 or 3 times ternate; petioles slender; leaflets ovate, small, sharply serrate, the terminal ones more elongated, more or less cleft, glabrous except the roughened veins and margin; stem leaves much reduced; peduncle sometimes nearly 20 cm. long, occasionally subsessile, not very stout; rays numerous, about equal, 2 to 4 cm. long; pedicels 2 to 3 mm. long; involucre wanting; involucel bractlets few, linear, a little longer than the pedicels; fruit oblong, 7 mm. long, rounded at each end; wings about half as broad as body; oil tubes in intervals 3 or 4; stylopodium low-conical; seed face deeply concave.

Type U. S. National Herbarium no. 397662, collected by Dr. E. Palmer at Alvarez, San Luis Potosí, September 5 to 10, 1902 (no. 114).

Deanea longipes Rose, sp. nov.

Perennial, 80 to 120 cm. high, simple below, glabrous; basal leaves much dissected, glabrous; ultimate segments lanceolate, acuminate, doubly serrate, or cleft and serrate; stem leaves much smaller, especially the uppermost ones; stipular sheath enlarged; inflorescence somewhat variable, the umbels either sessile or on slender peduncles 15 cm. long; involucral bracts 1 to several, leaflike, more or less toothed or cleft; involucel bractlets linear, entire, much shorter than the pedicels; rays 5 to 6 cm. long; pedicels 9 to 12 mm. long; flowers purplish; fruit glabrous, oblong, 8 mm. long; seeds concave on the face; stylopodia conical.

Collected by C. G. Pringle, at Trinidad, Puebla, August 5, 21, 1905 (no. 13496).

Deanea pringlei Rose, sp. nov.

Rootstock thick and tuberous; stems about one meter high, purplish, glaucous, glabrous or slightly roughened above; basal leaves twice pinnate; leaflets lanceolate, doubly crenate, nearly glabrous above, somewhat scabrous on the margin and veins; peduncles slender; rays few, 3 to 5 cm. long, puberulent; pedicels 2 to 3 mm. long; involucre of a single bract or wanting; involucels small, linear; stylopodia conical; fruit 8 mm. long, oblong, glabrous; oil tubes several in the intervals.

Type U. S. National Herbarium no. 396308, collected by C. G. Pringle on hills near Contadero, Tlaxcala, altitude 2,550 meters, August 27, 1901 (no. 8601).

Resembling *D. arguta*, but with differently shaped leaves, etc.

Deanea purpurea Rose, sp. nov.

Rootstock thick; stems 20 to 30 cm. high, green or if purplish dull, not at all glaucous, with short rough pubescence throughout; basal leaves twice or thrice ternate; peduncle roughish-pubescent; leaflets ovate, simply crenate, roughish-pubescent on both surfaces; peduncles slender; rays 9 or less, 2 to 4 cm. long; pedicels 2 to 3 mm. long; involucre wanting; involucel bractlets several, linear, longer than the pedicels; stylopodia low, conical; fruit 8 mm. long, oblong, glabrous; oil tubes several in the intervals.

Type U. S. National Herbarium no. 453753, collected by J. N. Rose and Jos. H. Painter between Somoriel and Las Lajas, Hidalgo, August 5, 1905 (no. 9212); also collected by C. G. Pringle at Hacienda de Cuyamaloya, Hidalgo, August 2, 1904 (no. 449).

This species is nearest *D. pringlei*, from which it differs in its rougher and not at all glaucous flowers, more pubescent leaves, etc.

Deanea (?) tolucensis (H. B. K.) Rose.

Ferula tolucensis H. B. K. Nov. Gen. & Sp. **5**: 12. *pl. 418.* 1821.

Peucedanum tolucense Hemsley, Biol. Centr. Am. **1**: 570. 1881.

This species, so long a desideratum in all our herbaria, has been frequently collected of late years and from several of the high mountains of central Mexico. An examination of mature fruit shows clearly that it does not belong to the true Peucedanum of the Old World or to the recently segregated genus Lomatium.

The following specimens are in the National Herbarium:

Jalisco: Volcano de Colima, M. E. Jones, 1893 (no. 235).
Mexico: Nevado de Toluca, C. G. Pringle, 1892 (no. 4233); also Rose & Painter, 1903 (no. 7960); Sierra de las Crucis, C. G. Pringle, 1903 (no. 5953).
Hidalgo: Sierra de Pachuca, C. G. Pringle, 1902 (no. 9816); also Rose & Hay, 1901 (no. 5596).
Puebla: Mount Orizaba, H. E. Seaton, 1891 (no. 118); also Rose & Hay, 1901 (no. 5717).

Deanea tuberosa Coult. & Rose.

Collected by J. N. Rose and Jos. H. Painter, near El Salto, Hidalgo, September 16, 1903 (no. 7064); also in barranca of Rio Aqueducto, near Santa Fé, Valley of Mexico, July 15, 1905 (no. 8618).

ERYNGIUM, NEW AND OLD SPECIES.

Eryngium altamiranoi Hemsley & Rose, sp. nov.

Stems erect, 30 to 50 cm. high, simple below, much-branched above; basal leaves deeply cleft, the edge with a white cartilaginous margin extending beyond the teeth into long white setae; upper stem and floral leaves sessile, deeply parted; heads short-peduncled, rarely 2 cm. long, ovoid, 10 cm. long; bracts few, ovate, pungent, entire or bearing one or even two teeth on each side, the margin white and the inner face cartilaginous and white, usually erect, inclosing the heads; bractlets linear, pungent, somewhat longer than the sepals; sepals ovate, thin, mucronate-tipped; fruit papillose, the papillae usually obtuse.

Type U. S. National Herbarium no. 253003, collected by F. Altamirano, October, 1891 (no. 20).

Common on the plains near Guadalajara.

Specimens examined:

Jalisco: C. G. Pringle, 1902 (no. 9814), and 1903 (no. 11462); Dr. E. Palmer, 1886 (no. 458); Rose & Painter, 1903 (no. 7338); F. Altamirano, 1891 (no. 20).

Eryngium carlinae Delar.

Collected by J. N. Rose and Jos. H. Painter near Tultenango, Mexico, October 13, 1903 (no. 7823); also between Somoriel and Las Lajas, Hidalgo, August 5, 1905 (no. 9220).

Eryngium comosum Delar.

Collected by J. N. Rose and Jos. H. Painter near El Salto, Hidalgo, September 16, 1903 (no. 7097); also on rocky banks of streams near San Angel, Valley of Mexico, August 15, 1905 (no. 9492).

Eryngium confusum Hemsley & Rose, sp. nov.

Stems from a slender spindle-shaped root, 20 to 45 cm. high, naked below, with scattered branches above and an umbel of usually 6 branches, glabrous; basal leaves oblanceolate, 5 to 8 cm. long, deeply toothed or cleft, rarely doubly cleft; lower stem leaves somewhat similar; upper stem leaves short, deeply cleft into narrow spinescent entire or toothed lobes; heads short-peduncled (2 to 5 cm. long); involucre bracts narrow, entire or with a tooth on each side, ending in a strong spinescent tip, longer than the heads, ascending; heads ovoid, 10 to 12 mm. long; bractlets small, a little longer than the calyx teeth, except the central ones, these much elongated, resembling the bracts; sepals broadly ovate, keeled on the back, and strongly mucronate at tip, bluish-tinged; fruit covered with white acuminate-pointed scales.

Specimens examined:

Oaxaca: On mountains northeast of Valley of Oaxaca, E. W. Nelson, October 3, 1904 (no. 1565, type); hills at Las Sedas, C. G. Pringle, August 16, 1894; also 1897 (no. 6710).

This species has been confused with *E. comosum*, *E. carlinae*, *E. beecheyanum*, and *E. wrightii*. It has fruit similar to *E. comosum*, but different leaves, heads, and bracts. It differs from the other three species in various ways, but especially in the acuminate fruit scales.

Eryngium leptopodum Hemsley?

Collected by J. N. Rose and Jos. H. Painter, between Somoriel and Las Lajas, Hidalgo, August 5, 1905 (no. 9191).

Eryngium monocephalum Cav.

Collected by J. N. Rose and Jos. H. Painter in oak woods between Pachuca and Real del Monte, Hidalgo, July 19, 1905 (no. 8692).

Eryngium serratum Cav.

Collected by J. N. Rose and Jos. H. Painter at Hacienda Ciervo, between San Juan del Rio and Cadereyta, Querétaro, August 20, 1905 (no. 9684); on rocky banks of stream near San Angel, Valley of Mexico, August 15, 1905 (no. 9491); between Somoriel and Las Lajas, Hidalgo, August 5, 1905 (no. 9228).

Eryngium sp.

Collected by J. N. Rose and Jos. H. Painter, between Somoriel and Las Lajas, Hidalgo, August 5, 1905 (no. 9190).

PRIONOSCIADIUM, NEW AND OLD SPECIES.

Prionosciadium diversifolium Rose.

Collected by J. N. Rose and Jos. H. Painter, in Cañon de la Mano Negra, near Iguala, Guerrero, August 11, 1905 (no. 9336).

Prionosciadium nelsoni Coult. & Rose.

Collected by J. N. Rose and Jos. H. Painter, in barranca near Cuernavaca, Morelos, September 12 and 13, 1905 (no. 10209).

Prionosciadium palmeri Rose, sp. nov.

Perennials from deep-seated roots; stem stout, about 2 meters high, much branched; basal leaves very large, twice ternate, then pinnately parted or lobed; main rachis and secondary branches not at all winged; leaf segments rather large, more or less confluent, cuneate at base, obtuse, more or less scabrous on the veins, especially below; primary and secondary peduncles umbellate; umbel proper many-rayed; rays stout, about 3 cm. long; pedicels 2 to 3 mm. long, involucre wanting; involucel bractlets minute; fruit oblong, 12 mm. long, glabrous, wings about as broad as body; oil tubes about 3 in the intervals.

Type U. S. National Herbarium no. 397608, collected by Dr. E. Palmer near Alvarez, San Luis Potosí, September 5, 1902 (no. 60).

Perhaps nearest *P. pringlei*, but it is apparently a stouter plant, and has more strongly toothed leaves, glabrous fruit, etc.

Prionosciadium palustre Rose.

Collected by J. N. Rose and Jos. H. Painter, on pedregal near Yautepec, Morelos, July 12 and 13, 1905 (no. 8563.)

Prionosciadium watsoni Coult. & Rose.

Collected by J. N. Rose and Jos. H. Painter, on limestone hillside near Ixmiquilpan, Hidalgo, July 7, 1905 (no. 8964); Hacienda Ciervo, between San Juan del Rio and Cadereyta, Querétaro, August 20, 1905 (no. 9640).

SPECIES OF SEVERAL GENERA.

Apium ammi Urban.

Collected by J. N. Rose and Jos. H. Painter, on mountain side, Hacienda de la Encarnación, Mexico, July 7, 1905 (no. 8467).

Centella asiatica (L.) Urban.

Collected by Dr. E. Palmer, near San Dieguito, San Luis Potosi, June, 1905 (no. 625).

This is the first time the genus has been reported from Mexico, although its occurrence there is not a surprise. It will doubtless be found in many places along the eastern coast.

Coaxana ebracteata Rose.

Oaxacana ebracteata Rose, Contr. Nat. Herb. **8**: 337. 1905, by error.

Stems tall, 60 cm. or more high, erect, glabrous; upper leaves twice ternate; leaflet ovate, acute, more or less cleft and sharply serrate; petioles wanting, the stipular bases of the leaves much enlarged and scarious; peduncles short, 7 to 8 cm. long; rays numerous, spreading, 3 to 4 cm. long; involucre and involucel bractlets wanting; flowers purplish, the sterile ones on slender pedicels, the fruiting ones very short or subsessile.

Collected by C. and E. Seler between Hurtztan and Oxchuc, Chiapas, March 11, 1906 (no. 2148).

Hydrocotyle sp.

Collected by J. N. Rose and Jos. H. Painter, on river bank near Ixmiquilpan, Hidalgo, July 29, 1905 (no. 9082).

Hydrocotyle sp.

Collected by J. N. Rose and Jos. H. Painter, on river bank in alluvial soil near Tomellín, Oaxaca, September 4, 5, 1905 (no. 10053).

Lomatium dasycarpum (Torr. & Gr.) Coult. & Rose.

Collected by E. A. Goldman in the San Pedro Martir Mountains, Lower California, July 15, 1905 (no. 1138).

This is new to the Mexican Flora.

Sphaenosciadium eryngiifolium (Greene) Coult. & Rose.

Collected by E. A. Goldman in the San Pedro Martir Mountains, Lower California, Mexico, 1905 (no. 1230).

This is new to the Mexican Flora.

ADDENDA.

A NEW IONOXALIS.

Ionoxalis stolonifera Rose, sp. nov.[a]

A very delicate plant producing long, slender, branching stolons; bulbs small for the genus (4 to 5 mm. in diameter), growing in damp moss on perpendicular cliffs; bulb scales thin, black, 3-nerved; leaflets 3, 5 to 18 mm. long, wedge-shaped, the apex strongly notched and the lobes usually very unequal; peduncles slender, usually longer than the petioles, solitary or few-flowered; sepals 2 mm. long; petals violet-purplish, 12 mm. long.

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[a] This remarkable species, inserted while the paper is in proof, is the only one herein published based on the collections of 1906.

Type U. S. National Herbarium no. 461983, collected by Dr. C. G. Pringle on Sierra de Tepoxtlan, September 3, 1906 (no. 13768); previously collected by J. N. Rose at same station (August 7, 1906, no. 11127).

This is a very peculiar species, differing from all others which I have ever seen in being stoloniferous. The leaflets are also peculiar in having the apex oblique, one lobe usually being much longer than the other.

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THE LEGUMINOSAE OF PORTO RICO

By J. PERKINS

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PREFACE.

In 1901 and 1902 Miss Janet Russell Perkins, Ph. D., under an appointment as scientific aid in the United States Department of Agriculture, was engaged at Berlin in a revision of the Leguminosae of Porto Rico. The revision was based upon a study of collections and literature, unaccompanied by field work in the island. It was originally intended to publish the results of this work conjointly with an account of the agricultural relations of the leguminous plants of that island, but as it proved to be necessary to postpone the preparation of this latter paper for more detailed investigation Miss Perkins's paper is now presented separately for publication.

This paper differs in several respects from the systematic treatment of leguminous plants presented in other numbers of these Contributions, and such differences must be taken only as an expression of the views of the author.

FREDERICK V. COVILLE,
Curator of the United States National Herbarium.

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THE LEGUMINOSAE OF PORTO RICO.

By J. Perkins.

INTRODUCTION.

During the preparation of the following paper on the Leguminosae of Porto Rico the writer has been impressed with the small number of endemic plants. Of the 67 genera and 141 species only 1 genus (Stahlia) and 8 species (*Cynometra portoricensis*, *Cassia stahlii*, *Cassia portoricensis*, *Sabinea punicea* (introduced into Cuba according to Gundlach), *Aeschynomene portoricensis*, *Lonchocarpus glaucifolius*, *Rudolphia volubilis*, *Schrankia portoricensis*) are peculiar to the island.

With respect to distribution, the genera that appear in Porto Rico may be divided into four classes—those which occur in Porto Rico alone; those found also in several or many of the other Antilles; those that appear in Mexico, the Antilles, and South America; and, lastly, the cosmopolitans. In the third and fourth classes there are many genera, while the number in the first and second is comparatively small.

Very many of the valuable economic leguminous plants are found on the island. Among the most important are: *Indigofera suffruticosa* (indigo), *Haematoxylon campecheanum* (logwood, campechy wood), *Pterocarpus officinalis* (kino, American dragon's blood), *Dolichos lablab* (seeds and pods), *Vigna unguiculata* (pods, seeds, and fiber), *Phaseolus vulgaris*, *Phaseolus lunatus*, *Cajanus indicus* (seeds and young pods), *Pachyrhizus erosus* (tuberous root), *Arachis hypogaea* (oil and seeds), *Abrus precatorius* (red seeds used as ornaments, extremely poisonous), *Adenanthera pavonina* (red seeds (condori) used as ornaments, eaten cooked with rice), *Albizzia lebbek* (wood, gum, tanbark), *Calliandra portoricensis* (gum, "copaltic"), *Hymenaea courbaril* (gum, "American copal," wood), *Stahlia monosperma* (fine wood), *Tamarindus indica* (fruit, pulp), *Acacia farnesiana* (fragrant flowers, falsely known as "Cassia flowers," used in perfumery, roots and pods used for dyeing black and tanning), *Clitoria ternatea*, *Sesbania grandiflora*, *Poinciana regia*, *Cassia fistula*, *Cassia grandis*, *Bauhinia kappleri*, *Caesalpinia gilliesii*, *Caesalpinia pulcherrima* (ornamental plants). *Inga vera*, *Erythrina micropteryx*, *Pithecolobium saman*, and others are used in shading coffee and cacao.

A goodly number of tropical weeds are also represented here, some being cosmopolitan, others occurring only in America. Such are *Mimosa pudica, Desmodium barbatum, D. triflorum* (cosmopolitan), *D. ascendens, D. axillare, D. supinum, D. spirale, Cassia tora* (cosmopolitan), *C. diphylla.*

The economic facts and the vernacular names contained in the notes have been obtained from Watt,[a] Urban,[b] Cook and Collins,[c] and many other reliable sources. In connection with the descriptions reference has been made to Cook and Collins, Economic Plants of Porto Rico,[c] whenever those authors mention a species, give a plate, or use a name not adopted in this paper. A large number of the species described have been examined in the herbarium of the Royal Botanical Museum in Berlin, especially valuable being the duplicates of Sintenis, Schwanecke, and Bertero. From the herbarium material, from the great English floras, and from Bentham's classical monographs has been derived much information in regard to geographical distribution. It has undoubtedly been of service in preparing this paper that in various trips in the Tropics an opportunity has been given the writer of seeing, in a living condition, a large number of the plants described.

The nomenclature generally followed has been that of Urban, although at times the Kew Index names have been used. Since the appearance of Urban's Flora Portoricensis[b] it has been necessary to interpolate several new forms and names and to reduce to synonymy a number of Bello's species. Likewise the lists of localities have been supplemented, as the material contained in the Berlin Herbarium was not so complete as that of the West Indian Herbarium of Professor Urban.

SYNOPSIS OF THE GENERA.

Flowers regular; petals valvate in the bud. MIMOSOIDEAE.
  Stamens indefinite, but at least more than 10.
    Stamens consolidated at the base or united and forming a tube; in several genera more than a single carpel. (INGEAE.)
      Leaves pinnate; style 1. 1. *Inga* (p. 140).
      Leaves bipinnate (pinnae sometimes 1-jugate bearing 1 to 3 leaflets); style 1.
        Legume thick, compressed, coriaceous or somewhat fleshy, involute, curved, or almost straight, indehiscent or dehiscent with contorted valves, sometimes separating into 1-seeded joints. 2. *Pithecolobium* (p. 141).

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[a] Watt, George. A dictionary of the economic products of India. 1885–1893.

[b] Symbolae Antillanae, volume 4, pp. 262 to 312, 1905.

[c] Contributions from the United States National Herbarium, volume 8, pages 57 to 269, 1903.

Legume flat, thin, indehiscent, or dehiscent with valves that are not contorted. 3. *Albizzia* (p. 142).

Legume straight or slightly curved; valves separating elastically longitudinally from apex to base. 4. *Calliandra* (p.143).

Stamens free, the inner ones sometimes united, forming a very short ring; carpel always 1. (ACACIEAE.) 5. *Acacia* (p. 144).

Stamens (as many as or) twice as many as petals.

Anthers eglandular. (EUMIMOSEAE.)

Valves of the legume separating from the persistent sutural replum.

Legume flatly compressed. 8. *Mimosa* (p. 147).

Legume subquadrangular. 7. *Schrankia* (p. 146).

Valves of the legume adhering to the sutural replum.

Legume narrowly linear; seeds longitudinal or oblique. 9. *Desmanthus* (p. 148).

Legume broadly linear; seeds transverse. 6. *Leucaena* (p. 146).

Anthers in the bud bearing a sessile or more often stipitate gland, which usually has disappeared at the time of flowering.

Seeds with endosperm. (ADENANTHEREAE.)

Flowers capitate. 10. *Neptunia* (p. 148).

Flowers spicate or racemose. 11. *Adenanthera* (p. 149).

Seeds without endosperm. (PIPTADENIEAE.)

Flowers in globose heads (in the Porto Rican species) or in spikes; legume flat, 2-valved, valves continuous, entire. 12. *Piptadenia* (p. 150).

Flowers in spikes; legume straight or arcuate, sometimes of enormous size, woody, coriaceous, or papery; sutures more or less thickened, persisting after the separation of the 1-seeded articulations as a replum. 13. *Entada* (p. 150).

Flowers zygomorphic, not papilionaceous; petals imbricate in the bud, the posterior one included in estivation. CAESALPINIOIDEAE.

Leaves abruptly pinnate; calyx lobes free to the disk; petals 0, 1, or 5; ovules 1 to 4. (CYNOMETREAE.)

Leaves without black glandular dots; petals on the outside levigate; stamens usually glabrous. 14. *Cynometra* (p. 151).

Leaves on the under surface with black glands; petals on the outside verrucose; stamens lanate-pilose. 15. *Stahlia* (p. 151).

- Leaves simply pinnate, occasionally 2-foliolate; calyx-lobes free to the disk, or perianth reduced to scale or obsolete. (AMHERSTIEAE.)
    - Leaflets 1-jugate. 16. *Hymenaea* (p. 152).
    - Leaflets many-jugate. 17. *Tamarindus* (p. 152).
- Leaves simple, or 2-foliolate with more or less connate leaflets. (BAUHINIEAE.) 18. *Bauhinia* (p. 153).
- Leaves simply pinnate; sepals 5, distinct or calyx lobes free to the disk; petals 5 or fewer or none; stamens 2 to 10, anthers basifixed or dorsifixed. (CASSIEAE.) 19. *Cassia* (p. 155).
- Leaves simple (rarely digitate); sepals 4 or 5, nearly equal, imbricate, more or less corollaceous, the outer one somewhat larger than the others; petals 4 or 5; stamens 3 or 4, the anthers basifixed, opening with oblique introrse pores. (KRAMERIEAE.) 20. *Krameria* (p. 163).
- Leaves bipinnate; calyx divided to the disk; petals usually 5, subequal or but slightly unequal; stamens 10. (EUCAESALPINIEAE.)
    - Common petiole very short, spine-pointed; rachis of the pinnae very long, flat, phyllodineous. 21. *Parkinsonia* (p. 163).
    - Common petiole plainly developed, not phyllodineous.
        - Calyx segments valvate in estivation. Flowers showy. 23. *Poinciana* (p. 165).
        - Calyx segments strongly imbricate in estivation.
            - Legume dehiscing lengthwise in the middle of the valves. 22. *Haematoxylum* (p. 164).
            - Legume indehiscent or dehiscing lengthwise at the sutures. 24. *Caesalpinia* (p. 165).

Flowers zygomorphic, papilionaceous; posterior petal (standard) outside in the bud. PAPILIONATAE.

- Stamens 10, all free. (SOPHOREAE.)
    - Pods winged; leaves with pellucid glandular lines and dots. 25. *Myrospermum* (p. 168).
    - Pods not winged.
        - A large tree; pods continuous. 26. *Ormosia* (p. 168).
        - A shrub; pods constricted between the seeds. 27. *Sophora* (p. 169).
- Stamens 10, monadelphous; pod 2-valved, not articulate; erect herbs or shrubs, with simple or digitately trifoliolate leaves. (GENISTEAE.)
    - Tube of the stamens slit along the top; style abruptly bent near the base. 28. *Crotalaria* (p. 170).
- Stamens 10, monadelphous or diadelphous; pod 2-valved, not articulated; erect, rarely climbing herbs, shrubs, or trees with imparipinnate leaves. (GALEGEAE.)
    - Anthers with glandular, apiculate or penicillate-pilose connective; plants with malpighiaceous hairs, i. e., appressed hairs attached by the middle. (INDIGOFERINAE.) 29. *Indigofera* (p. 172).

Connective not appendiculate; plants very rarely clothed with malpighiaceous hairs.

Seeds usually 1 or 2, rarely 3 or 4; pod small, 1-seeded, indehiscent; herbs or shrubs with glandular dots. (PSORALIINAE.) 30. *Dalea* (p. 173).

Seeds usually several or more, rarely with glandular hairs, very rarely with glandular dots.

Inflorescence or racemes usually terminal, or terminal and axillary. (TEPHROSIINAE.)

Style not bearded (rarely a small tuft of hairs on the stigma in Tephrosia); petals with short claws. 31. *Tephrosia* (p. 174).

Style bearded longitudinally inside; petals with very long claws; calyx long-tubuliform. 32. *Barbieria* (p. 175).

Inflorescence always axillary; stipe of the ovary without a discus at the base. (ROBINIINEAE.)

Pod not septate within.

Leaflets without stipels; stigma terminal; stipules small setaceous.

Leaves imparipinnate. 33. *Gliricidia* (p. 176).

Leaves paripinnate. 35. *Sabinea* (p. 177).

Leaflets with small stipels; stigma below the somewhat hooked apex of the style; stipules stiff, sometimes spinous. 34. *Corynella* (p. 177).

Pod with transverse partitions between the seeds.

Style long-bearded on the inner side. 36. *Cracca* (p. 178).

Style glabrous. 37. *Sesbania* (p. 179).

Stamens 10, monadelphous or diadelphous; pod articulated; usually erect herbs or shrubs, with imparipinnate leaves. (HEDYSAREAE.)

Upper stamen free toward the middle or connate with the others from the base; leaflets stipellate. (DESMODIINAE.)

Pod compressed, straight; calyx herbaceous. 43. *Desmodium* (p. 185).

Pod terete, straight; calyx glumaceous. 44. *Alysicarpus* (p. 191).

Stamens all united in a sheath more or less split on both the upper and the lower edges dividing the stamens into two bundles; flowers in axillary, usually few-flowered racemes, more rarely fascicled in the axils of the leaves; leaves pinnate; leaflets numerous, more rarely 1 to 3, without stipels. (AESCHYNOMENINAE.)

Stamen sheath split on the upper edge or entire. 38. *Pictetia* (p. 180).

Stamen sheath split on the under edge and soon after florescence also more or less on the upper edge. 39. *Aeschynomene* (p. 181).

Stamens all connate in a closed tube, the anthers alternately longer and fixed near the base and shorter and versatile; flowers in terminal or axillary spikes or heads, rarely somewhat racemose; leaves pinnate, usually with few leaflets, not stipellate. (STYLOSANTHINAE.)

Calyx with an elongated filiform tube; leaves pinnate.

Pod small, distinctly articulated, hooked at the end, ripening in the air; leaves pinnate with only 3 leaflets; flowers small, terminal or axillary, in dense hispidulous spikes. 40. *Stylosanthes* (p. 183).

Pod large, not articulated, not hooked at the end, ripening in the soil; leaves pinnate, usually with 4, seldom with 3 leaflets; flowers rather large, solitary, axillary with long pedicels. 41. *Arachis* (p. 184).

Calyx tube not elongated; leaves digitate, with 2 or 4 leaflets. 42. *Zornia* (p. 185).

Stamens 10, monadelphous or diadelphous; pod indehiscent; erect or scandent shrubs or trees, with imparipinnate leaves and entire leaflets. (DALBERGIEAE.)

Pod membranous, papyraceous, or coriaceous to ligneous, often compressed and winged, in any case not drupaceous.

Leaflets alternate, rarely reduced to 1. (PTEROCARPINAE.)

Anthers small, terminal, erect, the cells dehiscing by a small apical slit; pod suborbicular. 45. *Dalbergia* (p. 192).

Anthers dorsifixed, opening longitudinally.

Calyx blunt at the base, bracteoles usually somewhat orbicular; standard silky outside; pod thickly coriaceous. 46. *Drepanocarpus* (p. 193).

Calyx turbinate at the base; bracteoles small, deciduous; standard glabrous; pod papyraceous or thinly coriaceous, more or less incrassated in the center. 47. *Pterocarpus* (p. 194).

    - Leaflets opposite, very rarely alternate, rarely reduced to 1. (LONCHOCARPINAE.)
      - Pod not winged. 48. *Lonchocarpus* (p. 194).
      - Pod with 4 wings. 49. *Piscidia* (p. 196).
  - Pod drupaceous. (GEOFFRAEINAE.) 50. *Andira* (p. 196).
- Stamens 10, usually diadelphous; pod 2-valved; leaves ending in a tendril. (VICIEAE.) 51. *Abrus* (p. 197).
- Stamens 10, diadelphous or monadelphous; pod 2-valved, not articulate; scandent (rarely erect) shrubs or herbs, with usually pinnately trifoliolate leaves, often stipellate. (PHASEOLEAE.)
  - Upper stamen free or more or less united with the others; style glabrous above, rarely pilose below, very rarely bearded longitudinally on the inner side (Clitoria); nodes of the racemes not swollen. (GLYCININAE.)
    - Style bearded longitudinally on the inner side. 52. *Clitoria* (p. 198).
    - Style glabrous.
      - Standard spurred over the claw or at least with a tubercle. 53. *Centrosema* (p. 199).
      - Standard without spur or tubercle. 54. *Teramnus* (p. 201).
  - Upper stamen free or more or less united; style glabrous or pilose below; either the standard or the keel very large, larger than the other petals. (ERYTHRININAE.)
    - Standard the largest of the petals.
      - Leaves with 3 leaflets; calyx bilabiate or spathaceous, rarely equally 5-toothed; trees or erect shrubs. 55. *Erythrina* (p. 202).
      - Leaves with 1 leaflet; calyx with 4 segments, the two lateral small or indistinct; twining herbs. 56. *Rudolphia* (p. 203).
    - Keel the largest of the petals. 57. *Mucuna* (p. 204).
  - Style glabrous or pilose below; upper stamen free; nodes of the racemes swollen. (GALACTIINAE.)
    - Calyx segments 5, the upper one being 2-toothed or bifid. 58. *Calopogonium* (p. 206).
    - Calyx segments 4, the upper one consisting of 2 united. 59. *Galactia* (p. 206).
  - Style glabrous or pilose below; upper stamen free at the base, above more or less connate with the others; nodes of the racemes swollen. (DIOCLEINAE.)
    - Calyx with 4 subequal segments. 60. *Dioclea* (p. 209).
    - Calyx bilabiate, the upper lip very large, entire or bifid, the lower lip very small; the upper suture of the pod incrassated or 2-winged. 61. *Canavalia* (p. 209).

- Style glabrous or pilose below; upper stamen free; leaves gland-dotted. (CAJANINAE.)
  - Seeds 4 to many. 62. *Cajanus* (p. 210).
  - Seeds 2, very rarely 3. 63. *Rhynchosia* (p. 211).
- Style bearded longitudinally on the inner side or penicillate at the apex. (PHASEOLINAE.)
  - Keel twisted spirally. 64. *Phaseolus* (p. 213).
  - Keel truncate or with a curved beak, not spirally twisted.
    - Stigma subsessile, oblique, inflexed or inserted below the apex of the style.
      - Stigma very oblique, inflexed. 65. *Vigna* (p. 216).
      - Stigma subsessile, on the inner side of the style which is dilated at the apex. 66. *Pachyrhizus* (p. 218).
    - Stigma terminal, not oblique. 67. *Dolichos* (p. 219).

DESCRIPTIONS OF THE GENERA AND SPECIES.

1. INGA Scop.

Inga SCOP. Introd. 298. 1777.
Amosa NECK. Elem. **2**: 459. 1790.

Flowers 5 or 6-merous; calyx tubular or campanulate, dentate or broadly lobed; corolla tubular or funnel-shaped, the petals connate to the middle or beyond it; stamens indefinite, more or less united and forming a tube, long-exserted; ovary sessile; seeds numerous; legume linear, straight or somewhat curved, flat, quadrangular or almost terete, coriaceous or somewhat fleshy, almost always with thickened sutures, sub-dehiscent, pulpy between the seeds or rarely without pulp.—Trees or shrubs with pinnate leaves; rachis winged between the leaflets or sometimes not, almost always bearing sessile or stipitate glands; flowers often very large and tomentose, in umbels or globose heads, sometimes in oval elongated spikes, solitary or in fascicles, axillary or in crowded compound racemes on the ends of the branches.

KEY TO THE SPECIES.

- Stem, leaves, and flowers rusty brown tomentose or pubescent; rachis winged between the leaflets. 1. *I. vera.*
- Stem, leaves, and flowers glabrous; rachis not winged between the leaflets. 2. *I. laurina.*

1. Inga vera Willd.

(Urban, 263.)[a]

A large tree; leaflets 4 to 6-jugate, oval or elliptical-oblong, the largest 17 cm. long, 7 cm. wide, sessile; spikes 10 to 13 cm. long; flowers 4.5 to 5.5 cm. long; calyx 1 cm. long; corolla 1.5 cm. long; stamens white, legume about 20 cm. long.

In woods near Bayamon; near dwellings on Mount Jimenez, at Sierra de Luquillo; near Los Mameyes; between Aguas Buenas and Caguas, along roads; on Mount Mesa, near Mayaguez.—Jamaica, Haiti, Trinidad (Grisebach), Central America, Colombia.

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[a] The references under the species names are to the full synonymy given by Urban, Symbolae Antillanae, volume 4. All the pages cited, 262 to 312, were issued in 1905.

Inga vera is used extensively for shade in coffee plantations. (Cook and Collins, p. 167.) The bark of the tree is employed as an astringent, and in Guadaloupe for tanning and dyeing; the sweet pulp is often eaten, and it is also used in catarrhal maladies.

Local names, *guava*, *guaba*.

2. **Inga laurina** (Sw.) Willd.

(Urban, 262.)

Tree 10 to 15 meters high; leaflets 2-jugate, ovate or oval-oblong, obtuse or obtuse-acuminate, coriaceous, glabrous, the largest 7 to 12 cm. long; spikes axillary, elongated; flowers white; calyx 1.5 mm. long; corolla 5 to 6 mm. long; legume oblique at the base, 7.5 to 10 cm. long, 2.5 cm. wide.

In woods near Bayamon; near Juncos on Mount Goyo; Sierra de Yabucoa on Mount Cerro Gordo; near Maunabo, on Mount Mala Pasqua in the town of Utuado; near Cabo Rojo; near Mayaguez.—Haiti, St. Thomas, St. Croix (Eggers), St. John (Eggers), St. Kitts, Antigua, Guadeloupe, Dominica, Martinique, St. Lucia (Bentham), St. Vincent, Barbados, Grenada, Trinidad (Bentham).

According to Cook and Collins (p. 167) this species is second in importance only to *Inga vera* as a shade tree for coffee.

Local name, *guama*.

2. PITHECOLOBIUM Mart.

Pithecolobium MART. Flora **20**^{2}: Beibl. 114. 1837.
Spiroloba RAF. Sylva Tellur. 119. 1838.
Cathormion HASSK. Retzia **1**: 231. 1855.

Flowers 5-merous, seldom 6-merous, hermaphrodite, rarely polygamous; calyx campanulate or tubular, short-dentate; corolla tubular or funnel-shaped, petals connate beyond the middle; stamens indefinite, often connate; ovary sessile or stipitate, ovules numerous; legume compressed, circinate, curved, or almost straight, coriaceous or somewhat fleshy, two-valved, the valves after the dehiscence often twisted, oftener indehiscent or in some species separating into 1-seeded segments; seeds flat, ovate or circular, often imbedded in a fleshy pulp; funiculus filiform or forming an aril.—Trees and shrubs, the majority of which are unarmed, although many have thorny stipules; leaves bipinnate; flowers red or white; inflorescence capitate or spicate, axillary (or sometimes corymbose, racemose, or panicled at the extremities).

KEY TO THE SPECIES.

Leaflets glabrous beneath.	
Pinnae 2 to 5-jugate, leaflets 2 to 8-jugate.	1. *P. saman*.
Pinnae 8 to 12-jugate, leaflets 20 to 30-jugate.	2. *P. arboreum*.
Leaflets pubescent beneath.	3. *P. unguis-cati*.

1. **Pithecolobium saman** (Jacq.) Benth

(Urban, 264.)

A large tree; leaflets oblique, ovate-oblong or suborbiculate, 2 to 5 cm. long, 1.5 to 2.5 cm. wide; flowers rose-colored, in a globose head; calyx 8 mm. long; corolla 1.5 cm. long; legume 18 to 20 cm. long, 1.25 to 2.50 cm. wide.

Doubtfully indigenous. Near Bayamon at Cataño; near Manati on the way to Arecibo. Cuba, Jamaica (introduced, Bentham), St. Thomas (introduced, Eggers), St. Croix (do.), Guadeloupe (cultivated), Martinique (cultivated), St. Lucia (Grisebach), Trinidad (Hart). Native country, Central and South America.

Flowers and fruit, March to May. The pods are much eaten by cattle. According to Hart (cited in Cook and Collins, p. 221) "the tree gives a fine shade for 'Guinea grass' pastures and it is also an excellent one for planting in ordinary 'low-bite' pastures, both for the benefit of herbage and also as a shade for the cattle."

Local name, *saman*.

2. **Pithecolobium arboreum** (L.) Urb.

(Urban, 264.)

Forest tree 15 to 20 meters high, unarmed; leaflets oblique, falcate-oblong, somewhat obtuse, shining, dark green, 10 to 12 mm. long, 3 mm. wide; flowers whitish green in globose heads; calyx 2.5 mm. long; corolla 6.6 mm. long; legume red, 7 to 8 cm. long, 7 mm. wide; seeds black.

In woods near Bayamon; near Cayey at Las Cruces; near Utuado, in rocky districts at Los Angeles; near Mayaguez; near Quebradillas.—Cuba, Jamaica, Haiti, Mexico, Central America.

Local names, *cojoba*, *cojóbana*.

3. **Pithecolobium unguis-cati** (L.) Benth.

(Urban, 263.)

Tree 3 to 5 meters high, armed; leaflets obovate, orbicular or broadly oblong, strongly oblique, obtuse, 4 to 5 cm. long, 1 to 3 cm. broad; flowers whitish, in elongated heads; calyx 1 to 2 mm. long; corolla 6 to 7 mm. long; legume 10 to 12 cm. long, 7 mm. wide.

On the coast near Fajardo; near Ponce at Tallaboa in thickets; near Guanica on declivities at Punta de la Meseta; near Salinas de Cabo Rojo in woods on the coast.—South Florida (Chapman) and Keys, Bahama, Cuba (A. Richard), Jamaica, Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Bartholomew (Stockholm Herbarium), Barbuda, St. Kitts, Antigua (Grisebach), Guadaloupe, Les Saintes (Duss), Marie Galante (do.), Dominica, Martinique, St. Lucia (Grisebach), St. Vincent (do.), Bequia, Mustique (Kew Bull. no. 81, p. 250), Union (do.), Barbadoes, Grenada, Trinidad, Venezuela, New Grenada.

The bark of *P. unguis-cati* is a much-valued medicament, and it is this tree that furnishes the siliciferous wood of the Antilles.

Local names, *uña de gato*, *rolon*, *black bead;* near Guayanilla called "*escambron colorado*" (Cook and Collins).

3. ALBIZZIA Duraz.

Albizzia DURAZ. Mag. Tosc. 3^4: 11. 1772.

Flowers usually 5-merous, hermaphrodite or more rarely polygamous; calyx tubular or campanulate, toothed or shortly lobed; corolla funnel-formed; petals united one-half their length or more; stamens indefinite, united at the base only or in a long-exserted sheath; legume broadly linear, straight, flat, thin, indehiscent, or dehiscent with 2 inelastic valves not contorted after dehiscence, continuous, without pulp.—Trees or shrubs unarmed; leaves bipinnate, leaflets small and numerous or few and large; flowers white, rose, rarely purple, in globose heads or cylindrical spikes, axillary or racemose toward the extremities.

1. **Albizzia lebbek** (L.) Benth.[a]

(Urban, 264.)

Tree, unarmed; pinnae 2 to 4-jugate; leaflets, 5 to 9-jugate, oval-oblong or oblong, 3 to 4 cm. long, 1 to 1.5 cm. wide, unequal sided, very obtuse, the petiole bearing an oval gland above its base; flowers white, pedicellate, in long-peduncled clusters; calyx 6 mm. long; corolla 9 mm. long; legume flat-compressed, indehiscent or the valves tardily separated, glabrous 18 to 36 cm. long, 2.5 to 3.5 cm. wide.

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[a] For illustration see Cook and Collins, *pl. 15*, facing p. 70.

Seemingly spontaneous and cultivated near Bayamon; near Cataño; near Yabucoa on the coast; near Coamo along roads toward Baños; near Mayaguez at Algarrobo.—Bahama, Cuba (Grisebach), Jamaica, Haiti, St. Thomas, St. Croix, St. Martin (Stockholm herbarium), Antigua (Grisebach), Guadeloupe, Martinique, St. Vincent, Bequia (Kew Bull. no. 81, p. 250), Trinidad, Curaçao. Native country, southern and eastern Asia, tropical Africa.

Albizzia lebbek is an ornamental tree that is exceedingly good for avenues. Its roots do not penetrate very deep. It grows rapidly, flourishes in almost any soil, and may be propagated by cuttings. The wood seasons, works, and polishes well and is fairly durable, while the bark is used as a tan bark. From this tree is procured a gum that is said not to be soluble in water, but to merely form a jelly; it resembles gum arabic.

Local names, *amor platonico*, *flamboyán*. The last name is used for *Albizzia lebbek*, as well as for *Poinciana regia*, according to Urban.

4. **CALLIANDRA** Benth.

Anneslia SALISB. Parad. Lond. *pl. 64.* 1807.
Annesleya G. DON, Hist. Dichl. Pl. **2**: 396. 1832, as section.
Calliandra BENTH. Hook. Journ. Bot. **2**: 137, 138. 1840.

Flowers 5 or 6-merous, polygamous; calyx campanulate, toothed, rarely deeply divided; corolla campanulate or funnel-form, segments united to the middle; stamens indefinite, connate at the base or beyond it, much exserted, glandular-hairy, the anthers rarely glabrous; legume linear, straight or somewhat curved, narrowed at the base, flat, continuous, the sutural margins prominent, seldom terete, 2-valved, the valves separating elastically from apex to base.—Shrubs or small trees, usually armed; stipules membranaceous or foliaceous, persistent, sometimes transformed into thorns; leaves bipinnate; flowers showy, red or white, often with very long stamens, solitary or axillary.

KEY TO THE SPECIES.

Shrub, unarmed; pinnae 2 to 4-jugate; leaflets 10 to 25-jugate; calyx deeply toothed, ciliate on the margin; petals united only a little above the base, outside glabrous.	1. *C. portoricensis.*
Shrub, armed; pinnae 1-jugate; leaflets 4 to 9-jugate, rarely 13-jugate; calyx shortly toothed, glabrous; corolla united two-thirds or three-fourths of its length, outside densely sericeous-pilose.	2. *C. haematostoma.*

1. **Calliandra portoricensis** (Jacq.) Benth.

(Urban, 265.)

Shrub 1 to 4 meters high or tree 8 meters high, unarmed; leaflets linear or linear-oblong, 5 to 12 mm. long, glabrous; peduncle very slender; flowers white; calyx 2.5 mm. long; corolla 10 mm. long; legume linear, straight, 7 to 12 cm. long, 8 mm. wide, chartaceous, glabrous.

In woods and copses near Bayamon; near Fajardo on Mount Mula; near Juncos on calcareous mountains toward Florida, near Humacao; near Maunabo on Mount Mala Pasqua; near Cayey on the upper and lower Maton River and at Planaje and on Mount Cedro; near Coamo at Farajones, near Peñuelas on calcareous mountains near Tallaboa-Poniente; near Guanica at El Maniel; in moist land on the edge of the forest between

Barina and La Boca, and in the coast districts near Laguna; near Lares on declivities at Barrio Piletas; near Quebradillas; between Isabela and Quebradillas; near Toa Baja.—Bahama (Hitchcock), Cuba (Grisebach), Jamaica, Haiti, Vieques (Eggers), St. John, Grenada. Tropical continental America, tropical western Africa.

This shrub yields a gum, copaltic, that is used as a medicament in the West Indies.

Local names, *cojobillo*, *morir vivir cimarron*, *zarza boba* (Urban); *acacia puertoriqueña* (Cook and Collins).

2. **Calliandra haematostoma** (Bertero) Benth.

(Urban, 265.)

Shrub, armed; 2 to 3 meters high; leaflets oblong, obtuse, 3 to 7 mm. long, glabrous, subciliate; peduncle very short; stipules spiny or with spines at their base; corolla 5 mm. long; stamens red; anthers white; legume 8 to 10 cm. long, linear, villous-pubescent, coriaceous.

Near Guayanilla, on calcareous rocks of the coast at Peñon, rare.—Bahama (Bentham), Cuba (Bentham), Jamaica, Haiti, St. Thomas in Flaghill, not often found, with flowers in October (Eggers).

5. **ACACIA** Willd.

Sassa Druce; J. F. Gmelin, Syst. **2**: 1038. 1791.
Acacia Willd. Sp. Pl. **4**: 1049. 1806.
Phyllodoce Link, Handb. **2**: 132. 1831.

Flowers hermaphrodite or polygamous; calyx campanulate, toothed or lobed, the sepals seldom distinct or wanting; petals free or united, more or less connate, rarely united with the stamens, rarely wanting; stamens numerous, free or slightly and irregularly consolidated at the base; ovary sessile or stipitate, 1 to many-seeded; legume oval, linear or oblong, straight, curved or twisted, flat, convex or terete, membranous, coriaceous or woody, 2-valved or indehiscent, continuous or septate within, rarely with pulp, very seldom separating into segments; seeds usually oval, compressed, often with an aril.

Trees, rarely herbs, unarmed or with prickles or thorns; leaves bipinnate, with multijugate leaflets, or reduced to a phyllodium; stem glands more or less conspicuous; stipules small or wanting, membranous, rarely transformed into a curved thorn; flower-heads pedunculate, yellow, rarely white, 1 or 2-fasciculate in the axils of the leaves, or racemose at the extremities.

KEY TO THE SPECIES.

Armed.
- Ligneous plant, sometimes scandent; stem, branches, and peduncle armed with small recurved prickles; pinnae 6 to 12-jugate; leaflets 15 to 40-jugate; legume stipitate, 10 to 20 cm. long, 1 to 1.5 cm. wide, glabrous or glauco-tomentose, thin. 1. *A. riparia*.
- Small tree or shrub; stipular spines slender, straight; pinnae 2 to 8; leaflets 10 to 25-jugate; legume sessile, turgid, cylindrical or subfusiform, straight or curved, glabrous, 5 to 7 cm. long, 9 mm. wide. 2. *A. farnesiana*.

Unarmed.
- Tree; flowers spicate; pinnae 4 to 6-jugate; leaflets 10 to 16-jugate, ovate-elliptic or broadly oblong, oblique, obtuse, at length coriaceous, 1 cm. long, 5 mm. wide. 3. *A. nudiflora*.

1. **Acacia riparia** H. B. K.

(Urban, 266.)

Shrub 2 to 8 meters high or tree 15 meters high; leaflets oblong, linear, 5 mm. long, 1 mm. wide; flowers white; corolla 2.2 to 3.3 mm. long.

Near Bayamon, in thickets; near Juncos, on Mount Florida; near Maunabo, on Punta de la Tuna and near Punta Mala Pasqua; near Cayey on Morillos Brook; near Coamo, in thickets on the Yuey River toward Salinas; near Guanica, in thickets on the coast around the lagoon; near Cabo Rojo, on hills toward Guanajibo; near Mayaguez, on the slopes of Mount Mesa; near Maricao, on Mount Alegrillo; near Añasco; near Rincon, on the mountains at Calvache; near Aguadilla in thickets.—Jamaica (Grisebach), Haiti (Lamarck Herbarium), St. Thomas, St. Croix (West), St. Martin (Stockholm Herbarium), St. Bartholomew (do.), Antigua (Grisebach), Guadeloupe, Martinique, St. Vincent, Grenada, Trinidad, tropical South America.

Local name, *zarza*.

2. **Acacia farnesiana** (L.) Willd.

(Urban, 265.)

A large shrub; leaflets linear, 6 mm. long, 1 mm. wide.

Near Bayamon, in gardens; near Coamo, about Los Baños; near Guanica on Mount Puerco; near Cabo Rojo, at Salinas in forests on the seashore and at Puerto Real; near Añasco, on Tula range.—Bahama, Cuba, Jamaica (Grisebach), Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Martin (Stockholm Herbarium), St. Bartholomew (Stockholm Herbarium), Antigua (Grisebach), Guadeloupe, Dominica, Martinique, St. Lucia (Grisebach), St. Vincent, Barbados, Grenada, Tobago, warmer regions of the earth.

So generally cultivated for the perfume of its flowers and so frequently established as an escape from cultivation, that it is difficult to determine where it is really indigenous. It appears, however, to be so in western America, from northern Chile to Texas, not, perhaps, in Brazil nor Guiana.

Abundant in tropical and subtropical northern central Australia, and in the interior of northeastern Australia, and perhaps also really indigenous in south tropical Africa, but introduced only in East India, northern tropical Africa, and the Mediterranean region.

The roots and pods of this plant have an alliaceous odor and in the Antilles are used for tanning, dyeing black, and in baths. The fragrant flowers (in trade falsely known as cassia flowers—*cassie* of the French) are much used in the making of perfumery. A gum exudes from the stem in considerable quantities. It is considered superior to gum arabic in the arts and in medicine. The wood is white, close-grained, hard, and tough.

Local name, *aromo*.

3. **Acacia nudiflora** Willd.

(Urban, 266.)

Tree 8 to 15 meters high; flowers white or yellow-white, later becoming brown; legume shortly stipitate, straight or a little curved, flat, 10 cm. long, 1.3 to 1.9 cm. wide, the valves coriaceous.

Near Fajardo, on the mountains toward Ceiba and in clayey soil of the seashore; near Naguabo, in forests on the coast at Candelero; near Yabucoa, in thickets on the coast at Puerto de la Vaca.—Haiti (Grisebach), St. Thomas, St. John (Bentham), Antigua (Grisebach), Gaudeloupe, Dominica, Martinique.

Local names, *cojoba*, *cojóbana*, *tamarindo cimarron* (Urban); *acacia nudosa* (Cook & Collins).

6. LEUCAENA Benth.

Leucaena BENTH. Hook. Journ. Bot. **4**: 416. 1842.

Flowers 5-merous, sessile, usually hermaphrodite; calyx tubular-campanulate, dentate; corolla free; stamens 10, exserted; ovary stipitate, multiovulate; style filiform; legume stipitate, broadly linear, flat, coriaceous, 2-valved, the valves continuous; seeds flat, ovate, transverse.—Trees or shrubs, unarmed; leaves bipinnate, the rachis with or without glands; the leaflets small, multijugate, or large and paucijugate; stipules minute; flower-heads white, axillary, fascicled, or racemose at the extremities.

1. **Leucaena glauca** (L.) Benth.

(Urban, 266.)

Tree 10 to 20 meters high, rarely a shrub, unarmed; pinnae 4 to 8-jugate; leaflets 10 to 20-jugate, oblong-linear, pointed, oblique at the base, 11 to 16 mm. long, 4 mm. wide; flowers minute, white; legume glabrous, 10 to 15 cm. long; seeds compressed, transverse to the valves.

Near Bayamon, in mountain forests and thickets; near Comerio, in thickets; near Coamo, in the valley of Quebrada, Morena brook; near Guanica, in the forest of Mount El Maniel; near Mayaguez.—Bermuda, Bahama, Cuba, Jamaica, Cayman (Hitchcock), Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Martin (Stockholm Herbarium), St. Kitts, Antigua (Grisebach), Guadeloupe, Dominica, Martinique, St. Vincent, Bequia (Kew Bull. no. 81, p. 250), Mustique (do.), Barbados, Grenada, Tobago, Trinidad, Curaçao. In the warmer regions of both hemispheres, but probably indigenous only in tropical America.

The firm wood of *Leucaena glauca* is used for making tools, and the young fruit and the ripe seeds are eaten raw with rice. By some authors given as a tree (Urban), by others as a shrub (Stahl, cited by Cook and Collins, p. 175).

Local names, *acacia pálida* (Urban); *hediondilla* (Cook and Collins).

7. SCHRANKIA Willd.

Schrankia WILLD. Sp. Pl. **4**: 1041. 1806, not Medic. 1792.
Leptoglottis DC. Mem. Legum. 451. 1825.
Schranckia BENTH. Hook. Journ. Bot. **4**: 413. 1842.
Morongia BRITTON, Mem. Torr. Club **5**: 191. May, 1894.

Flowers 5 or 4-merous, pedicellate, hermaphrodite or polygamous; calyx minute; corolla funnel-form, the segments connate to the middle; stamens twice as many as the petals, free or cohering at the base, exserted; ovary subsessile, multiovulate; style filiform; legume linear, subquadrangular, aculeate throughout with spreading prickles, the valves separating from the persistent sutural replum; seeds oblong, quadrangular.—Herbs or undershrubs, armed with short recurved prickles; leaves bipinnate; flower-heads globose, white or purple, axillary, solitary or fascicled, the stamens in the male flowers often flatly compressed.

1. **Schrankia portoricensis** Urb.[a]

(Urban, 267.)

Shrub, climbing; branches glabrous or at leaf insertions slightly hairy; leaves 7 to 12 cm. long with petioles 3 to 4 cm. long; pinnae 4 to 7-jugate; leaflets 15 to 20-jugate, linear, obtuse or somewhat acute, 3 to 6 mm. long, the veins inconspicuous, glabrous; flower heads axillary, solitary, 6 to 8 mm. in diameter, light yellow; calyx minute, ¼ as long as the corolla, cupulate, slightly divided, with 6 to 8 substipitate glands on the margin; corolla 3 mm. long; legume subsessile, 4 to 5 mm. in diameter, 1.5 to 4 cm. long, aculeate; seeds subrectangular, 4.5 to 5 mm. long, 2.5 mm. wide, black.

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[a] Cook and Collins, p. 194, as *Morongia distachya.*

Near Coamo, in the mountain forests of San Ildefonso and on shady slopes in El Tendal Valley. Indigenous.

Local name, *cuernecillo.*

8. MIMOSA L.

Mimosa L. Sp. Pl. **1:** 516. 1753.
Lomoplis Raf. Sylva Tellur. 118. 1838.

Flowers 4 or 5, rarely 3 to 6-merous, hermaphrodite or polygamous; calyx usually small, sometimes wanting or paleaeform, often laciniate or fimbriate, rarely campanulate and short-toothed; corolla campanulate or funnelform; stamens (as many as or) twice as many as the petals, free, exserted; ovary sessile or substipitate, 2 to many-seeded; style filamentose; legume oblong or linear, compressed, rarely incrassated, membranous or coriaceous, valves separating entire or in transverse segments from the persistent sutural replum; seeds ovate or oblong, flat.—Decumbent or erect herbs, scandent undershrubs, or trees, unarmed or aculeate; leaves bipinnate, rarely wanting or reduced to a leaflike stem; petiolar glands present; flowers small, in globose heads or cylindrical spikes, axillary or racemose toward the extremities, solitary or fascicled.

KEY TO THE SPECIES.

Pinnae 2-jugate, rarely 1-jugate; leaflets 15 to 25-jugate; petiole and peduncle unarmed; legume 1.5 to 2 cm. long, 4 mm. wide, covered with recurved bristles. 1. *M. pudica.*

Pinnae 3 to 5-jugate; leaflets 3-jugate; petiole and peduncle armed; legume 5 to 5.5 cm. long, 2 cm. wide, with large recurved prickles on the margins. 2. *M. ceratonia.*

1. Mimosa pudica L.

(Urban, 267.)

Undershrub or an herb, often scandent, armed with infrastipular and scattered prickles; leaflets oblong-linear, pointed, ciliate with adpressed bristles, glabrescent, 10 to 11 mm. long, 2 mm. wide, membranous; flower-heads oval.

Near Bayamon; near Maricao, along roads; near Mayaguez, around the fortress.—Cuba, Jamaica, Haiti, St. Thomas, St. Croix, St. Kitts (Grisebach), Antigua (do.), Guadeloupe, Martinique, St. Lucia (Grisebach), St. Vincent, Grenada, Tobago, Trinidad. Continental tropical America, tropical Asia, probably introduced.

A common weed in most parts of the region, naturalized also in many parts of tropical Africa.

A medicament is made from the roots, leaves, and seeds of *Mimosa pudica* that is used by the country people.

Local names, *morivivi, morir-vivir, sensitiva.* Sensitive plant.

2. Mimosa ceratonia L.

(Urban, 267.)

Shrub 4 meters high, decumbent or ascending; branches and petioles armed with small recurved prickles; leaflets obovate or orbiculate, 1.5 to 2.5 cm. long, membranous, 3-nerved; flower-heads globose, racemose toward the extremities; white.

Near Bayamon; near Yabucoa, in mountain woods at Guayabota; near Maunabo, in thickets at Punta de la Tuna; near Mayaguez, on the slopes of Mount Mesa; near Manati in the primeval forest of Mount Mala Pasqua.—St. Thomas, St. Croix (West), Antigua (Grisebach), Gaudeloupe, Dominica, Martinique, St. Lucia (Bentham), St. Vincent.

This plant is perhaps found on the South American continent, but *M. obovata* is often mistaken for it.

Local name, *zarza.*

9. **DESMANTHUS** Willd.

Acuan Medic. Theod. 62. 1786.
Desmanthus Willd. Sp. Pl. **4**: 1044. 1805.
Desmanthea DC. Prod. **2**: 444. 1825, as section.

Flowers 5-merous, sessile, hermaphrodite or the lower ones male or neuter; calyx campanulate, shortly toothed; petals free or slightly cohering; stamens 10 or 5, free, exserted; ovary subsessile, multiovulate; style subulate, or sometimes incrassate above; stigma terminal, truncate, concave; legume linear, straight or curved, compressed, continuous or slightly septate, 2-valved, the valves adhering to the sutural replum; seeds compressed, subrhomboidal. Perennial herbs or undershrubs; leaves bipinnate, leaflets small; stipules setaceous, persistent; flower-heads subglobose, often paucifloreus, solitary, axillary.

1. **Desmanthus virgatus** (L.) Willd.

(Urban, 268.)

Undershrub, decumbent or ascending, 2 to 3 meters high; pinnae 1 to 7-jugate, petiole bearing an ovate-oblong gland between the lowest pair; leaflets 10 to 20-jugate, oblong-linear, 5 to 8 mm. long, 2 mm. wide; flower-heads with a few white flowers, 5 to 9 mm. in diameter; legume straight or slightly falcate, 6 to 8 cm. long, 2 mm. wide, 20 to 30-seeded.

Near Guanica, on the seashore at Caño Gordo and on dry grassy tracts around the lagoon; near Mayaguez, at the fortress.—Bermuda (Hemsley), Cuba, Jamaica, Haiti, Gaudeloupe, Martinique, Grenada. Tropical and subtropical America; common from Buenos Ayres to the West Indies. Tropical Asia; probably introduced into East India.

Local name, *desmanto rayado.*

2. **Desmanthus virgatus strictus** (Bertol.) Griseb.

(Urban, 268.)

Shrub 0.5 to 2 meters high or small tree 3 to 4 meters high; flowers white.

Near Fajardo, on roadside; near Aibonito, between Algarrobo and Cariblanco; near Coamo, about Salinas; near Peñuelas, on shady slopes of Mount Llano; near Guanica, on the margins of woods between La Boca and Barinas and about lagoons; near Salinas de Cabo Rojo, in the coast districts, near Aguadilla.—Bahama, Cuba, Haiti, St. Thomas, St. Croix, St. Bartholomew (Stockholm Herbarium), Martinique, St. Vincent, Barbados, Tobago.

Variety *strictus* in Porto Rico and also in the other islands differs obviously from the type and is easily distinguished from it.

10. **NEPTUNIA** Lour.

Neptunia Lour. Fl. Cochinch. **2**: 653. 1790.
Hemidesma Raf. Sylva Tellur. 119. 1838.

Flowers 5-merous, sessile, the upper hermaphrodite, the lower masculine or neuter; calyx campanulate, shortly toothed; petals cohering to the middle or free; stamens 10, rarely 5, exserted; ovary sessile, multiovulate; style filiform, with a small, terminal, concave stigma; legume shortly and broadly oblong, oblique and almost at right angles with the short stipes, the apex rounded but with a distinct apiculum, compressed, thinly coriaceous or submembranous, 2-valved, the valves depressed between the seeds or indistinctly septate; seeds transverse, ovate.—Perennial herbs or decumbent or aquatic undershrubs, stems usually compressed or triangular; leaves bipinnate, the leaflets small; stipules membranous, obliquely cordate; flower heads ovate-globose, axillary, solitary, the lower neuter flowers with elongated petaloid staminodia.

1. **Neptunia plena** (L.) Benth.

(Urban, 268.)

Undershrub, decumbent or ascending; pinnae 2 or 3-jugate, the petiole bearing a gland between the lowest pair; leaflets 14 to 20-jugate, narrowly linear, 4 to 7 mm. long, 2 mm. wide; bracts in the middle of the peduncle alternate, cordate, longer persistent than in other species; flower-heads oval, the flowers yellow, the calyx 2 mm. long; corolla 3.5 mm. long; anthers brown; legume stipitate, at length deflexed, 3 to 4 cm. long, 1 cm. wide, 5 to 20-seeded.

Near Maunabo, at Punta de la Tuna; near Guanica, on the swampy shore of the lagoon toward La Plata; between Vega Baja and Dorado, in sandy districts; near Dorado, on inundated sandy land.—Cuba (Richard), Jamaica (Grisebach), Haiti, Antigua (Grisebach), Guadeloupe, Martinique, St. Vincent, Union (Kew Bull. no. 81, p. 249), Grenada, Curaçao, South America, tropical Asia (introduced).

The plant figured in the Botanical Register[a] as *N. plena*, and described as having a spongy floating stem, was probably *N. oleracea*.

Local name, *desmanto amarillo*.

11. **ADENANTHERA** L.

Adenanthera L. Sp. Pl. **1**: 384. 1753.
Stachychrysum Boj. Hort. Maurit. 114. 1837.
Gonsii Adans. Fam. **2**: 318. 1763.

Flowers hermaphrodite or polygamous, 5-merous, substipitate; calyx campanulate, shortly toothed; corolla segments coherent below or free; stamens 10, free, scarcely exserted; ovary sessile, multiovulate, style filiform, stigma small, terminal; legume linear, usually curved, compressed or often turgid over the seeds, usually incurved or falcate, 2-valved, usually septate; seeds scarlet or two-colored, thick, the testa hard, smooth.—Trees, unarmed; leaves bipinnate; leaflets small, multijugate; flowers white or yellowish; racemes often elongated, solitary or fascicled in the axils or panicled at the extremities.

1. **Adenanthera pavonina** L.

(Urban, 269.)

Tree, 5 to 8 meters high; pinnae 2 to 5-jugate; leaflets 6 to 10-jugate, ovate or oblong-elliptical, 2.6 to 5 cm. long, 1 to 2.5 cm. broad, very obtuse, glabrous; flowers in racemes; calyx 1 mm. long; corolla 3.5 mm. long; legume 10 to 27 cm. long, 1 to 1.5 cm. wide, brown outside, golden yellow inside, linear, compressed, incurved; seeds scarlet, smooth.

Cultivated and seemingly spontaneous near Bayamon; near Cabo Rojo; near Mayaguez; near Añasco, around Hacienda Pagan.—Cuba (Grisebach), Jamaica (do.), Cayman (Hitchcock), St. Thomas (Eggers), St. Croix (do.), St. John (do.), Guadaloupe, Martinique (Duss), St. Vincent, Bequia. Native country tropical Asia.

This plant is introduced in the West Indies and other parts of tropical America, and possibly in tropical Africa and tropical Australia. The glistening red seeds (condori) are worn as ornaments by the women and, roasted or boiled with rice, they are used as food. From the roots in Cuba and Haiti an emetic is made, and a remedy used for rheumatism is procured by boiling the leaves. The wood is sometimes used as a dye, but chiefly as a substitute for the true red sandalwood. The heartwood is red, hard, closegrained, durable, and strong, and is used for house building and cabinet making.

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[a] Bot. Reg. **32**: *pl. 3.* 1846.

Local names, *coralitas*, *mato*, *mato colorado*, *palo de mato*, *peronilas*.

12. PIPTADENIA Benth.

Piptadenia BENTH. Hook. Journ. Bot. **4**: 334. 1842.
Schleinitzia WARB. Engl. Bot. Yahrb. **13**: 336. 1891.

Flowers sessile, 5-merous; calyx campanulate, shortly toothed; corolla connate to the middle; stamens 10, free, exserted; ovary subsessile; ovules 3 to many; legume stipitate, rarely sessile, broadly linear, flat, membranaceous or subcoriaceous, 2-valved, the valves continuous, without pulp; seeds compressed; funiculus filiform.—Trees or shrubs, unarmed or aculeate; leaves bipinnate; leaflets small, multijugate, rarely large and paucijugate; flowers small, white or greenish, cylindrically spicate or globose-capitate, solitary or fascicled, axillary or panicled at the extremities.

1. **Piptadenia peregrina** (L.) Benth.

(Urban, 269.)

Shrub 4 meters high or tree 20 meters high, unarmed; pinnae 15 to 30-jugate, leaflets 30 to 80-jugate, minute, 2 to 4 mm. long, 1 to 1.5 mm. wide, linear, glabrescent; petiole puberulous, bearing a gland above the base; flower heads white, small; calyx 1.5 mm. long; corolla 3.5 mm. long; legume 5 to 15 cm. long, 1.5 cm. broad, subcoriaceous, 2-valved.

Near Bayamon, in mountain woods at Toa Baja; near Aibonito, on slopes near Buena Vista de la Plata; near Sabana Grande, on the Estero River; near Cabo Rojo, toward Guanajibo; near Mayaguez; near Rincon, at Barrio del Pasto; Manati, in thickets near Garrochales.—Haiti, Dominica, St. Vincent (Grisebach), Trinidad (Bentham). Tropical America: Brazil, provinces of Rio Janeiro, Minas Geraes, Goyaz, and Rio Negro; Guiana, Venezuela.

Local names, *cojóbana*, *cojoba*, *cojobillo*, *cojobo*.

13. ENTADA Adans.

Entada ADANS. Fam. **2**: 318. 1763.

Flowers spicate, 5-merous, sessile or shortly pedicellate; calyx campanulate, toothed or deltoid-lobate; petals free or coherent at base, oblong-lanceolate or linear, valvate; stamens 10, usually exserted, the anthers elliptical or roundish with a terminal caducous gland; pollen-grains indefinite; ovary subsessile, multiovulate; style filiform; stigma terminal, truncate, concave; legume straight, sometimes of enormous size; seeds flattened, exalbuminous; testa with a central areole.—Trees or climbing shrubs, unarmed; leaves bipinnate, the number of pinnae and of leaflets very variable; spikes solitary or fascicled from the upper axils, or panicled at the extremities; hermaphrodite or polygamous.

1. **Entada polyphylla** Benth.

(Urban, 269.)

A large shrub 5 meters high; pinnae 4 to 8-jugate; leaflets 12 to 20-jugate, linear-oblong, obtuse, retuse, clothed beneath with short adpressed hairs; spikes numerous in terminal racemes, rachis and petioles puberulent; legume 7.5 cm. long.

Near Fajardo, on the river at the base of Mount Mula; between Manati and Vega Baja, in sandy districts.—South America, and in related forms in Guadeloupe, Martinique, and St. Vincent.

Local name, *tamarindillo*.

14. CYNOMETRA L.

Cynometra L. Sp. Pl. **1**: 382. 1753.
Iripa ADANS. Fam. **2**: 508. 1763.
Cynomora R. HEDWIG, Gen. 304. 1806.
Metrocynia THOU. Gen. Nov. Madag. 22. 1806.

Calyx with a rather short or very short receptacle; segments 4 or 5, thin, imbricate in estivation, usually reflexed at flowering; petals 5, subequal, sometimes one or two anterior minute, not verrucose; stamens 10, rarely indefinite, free; filaments glabrous; ovary sessile or shortly stipitate, cohering with or free in the receptacle; style filiform; stigma small, truncate or rounded; legume obliquely ovoid, obovoid, or reniform, rarely straight, coriaceous, turgid or slightly compressed, rugose, verrucose, rarely levigate, 2-valved; seeds exalbuminous.—Unarmed trees or shrubs; leaves paripinnate; leaflets 1 to 6 jugate, oblique, coriaceous; flowers usually reddish, small, in axillary or lateral clusters or short racemes; bracts ovoid, membranous, at first imbricate, later deciduous, rarely persistent; bracteoles wanting or, when present, membranous and colored.

1. **Cynometra portoricensis** Krug & Urb.

(Urban, 270.)

Tree, 15 meters high; stipules wanting; leaflets 1-jugate, oblique, obovate-oblong, 1.5 to 3 cm. long, 0.6 to 1.2 cm. wide, entire, coriaceous, glabrous, shining; inflorescence axillary, rachis 5 mm. long; legume semiorbicular, 2.5 to 3 cm. long, 1.4 to 1.8 cm. wide, crustaceous, sublevigate, brown.

Near Rincon, on wooded hills at Quebrada del Salto. Indigenous.

15. STAHLIA Bello.

Stahlia BELLO, Anal. Soc. Esp. Hist. Nat. **10**^{2}: 255. 1881.

Calyx with obconical receptacle and 5 free, subequal, obtuse segments; petals 5, subequal, dorsally multiverrucose; stamens 10, free, filaments lanate; ovary sessile, free at the fundus of the receptacle; style filiform; stigma small, truncate; legume roundly ovoid, somewhat compressed, coriaceous, indehiscent (according to Bello very late dehiscent); seeds 2, exalbuminous; bracts membranous, not imbricate, caducous; bracteoles wanting.—Unarmed trees; leaves paripinnate; leaflets paucijugate, oblique, thin, the lower surface glandular; flowers light yellow, not large, in axillary or terminal racemes.

This is the only endemic genus of Leguminosae in Porto Rico.

1. **Stahlia monosperma** (Tul.) Urb.

(Urban, 270.)

Handsome tree 5 to 20 meters high; leaves 24 to 30 cm. long; leaflets 4 to 6-jugate, ovate-oblong, 6 to 9 cm. long, 2 to 4 cm. wide, with subcordate or truncate base; inflorescence 10 to 20-flowered, often 10 cm. long; sepals 6 to 7 mm. long, 4 to 5 mm. wide; petals pale yellow, 10 to 11 mm. long, 5.5 to 6 mm. wide; anthers purple; legume 3.5 to 4.5 cm. long, 2.5 to 3 cm. wide, glabrous, red when mature.

Flowering from March to May, fruiting in August and September.

In littoral woods near Rio Grande, at La Estancia; near Ceiba; near Naguabo in the woods at Guyacan; near Guanica in the woods of La Boca, at Barinas and at La Plata.

The strong wood of this tree is much used in the manufacture of household furniture.

Local names *cóbana, polisandro.*

16. HYMENAEA L.

Hymenaea L. Sp. Pl. **2**: 1192. 1753.
Courbari Adans. Fam. **2**: 317. 1763.
Tanroujou Juss. Gen. 351. 1789.
Courbaril Plum.; Endl. Gen. 1317. 1841.

Calyx with thick, campanulate receptacle, its segments 4, imbricate; petals 5, sessile, oblong or obovate, subequal or the posterior one often larger, glandular; stamens 10, free, glabrous; anthers glandular; ovary subsessile; style filiform; stigma terminal, small; legume obliquely obovate or oblong, thick and often almost terete, coriaceous or subligneous, indehiscent; seeds few, exalbuminous, without aril.—Unarmed trees; leaves paripinnate; leaflèts coriaceous, glandular-punctate; flowers usually large, white, in paniculate racemes; bracts and bracteoles ovate or orbicular, concave, caducous.

1. Hymenaea courbaril L.[a]

(Urban, 270.)

Tree 10 to 20 meters high; leaves bifoliate; leaflets leathery, polished, falcate-ovate or oblong, 6 to 10 cm. long, 2.5 to 4 cm. wide, shortly petiolate; flowers white, in many-flowered terminal cymes; calyx segments ovate, obtuse, leathery, 15 mm. long; petals nearly equal, as long as the calyx segments; legume ligneous, thick, 7.5 to 10 cm. long, 5 to 6 cm. wide, indehiscent, filled with mealy pulp.

Near Bayamon; in the Sierra de Luquillo at Mavi; near Juncos in the woods of Mount Santo de Leon; near Maunabo, at Emajagua; near Mayaguez; near Manati.—Cuba (Grisebach), Jamaica, St. Thomas, St. Croix, St. John (Eggers), St. Bartholomew (Stockholm Herbarium), Antigua (Grisebach), Gaudeloupe, Dominica, Martinique, St. Lucia (Grisebach), St. Vincent, Bequia (Kew Bull. no. 81, p. 249), Mustique (do.), Brazil, Guiana, Colombia.

From the trunk of *Hymenaea courbaril* (locust tree, quapinole, jutahy, jatahy, or jatobà) a clear balsam drops to the ground, where it hardens. It is found in pieces weighing sometimes several pounds. This resin is known as American copal, resina copal, or courbaril, and is used by the Brazilian physicians and by the Indians as a medicament. The red wood is hard and heavy and is known in trade as courbaril wood. Among the Indians the sweetish pulp is a favorite food. They understand how to polish the resin most beautifully, and they use it for all kinds of ornaments, especially for the well-known lip decorations, tembeta (of the Amazon near Paraná).

Local name, *algarrobo.*

17. TAMARINDUS L.

Tamarindus L. Sp. Pl. **1**: 34. 1753.

Calyx with a narrowly turbinate receptacle and 4 strongly imbricated membranous segments; petals 3 (1 posterior, 2 lateral), oblong or obovate-oblong, subequal, shortly clawed; 2 anterior petals minute, setaceous or squammiform; fertile stamens 3, the anterior connate nearly half their length, alternating with minute or rudimentary staminodia; ovary stipitate, multiovulate; style elongated; stigma terminal, truncate, capitate; legume oblong or oblong-linear, thick, curved or nearly straight, compressed, indehiscent; epicarp thin, crustaceous; mesocarp pulpy; endocarp thick and fleshy, forming complete partitions between the seeds; seeds obovate-elliptical or roundish, compressed, with a thick, shining testa, each side marked with a large faintly defined areole; albumen none.—Unarmed trees; leaves paripinnate; leaflets multijugate, small, coriaceous, oblong, obtuse, reticulate, subsessile; stipules small, caducous; flowers yellowish or red-striped, in terminal racemes; bracts and bracteoles, ovate-oblong, colored, caducous.

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[a] For illustration of fruit see Cook and Collins, *pl. 41*, facing p. 164.

1. **Tamarindus indica** L.

(Urban, 270.)

Tree 5 to 8 meters high, wholly glabrous or extremities at first thinly pubescent or puberulous, sometimes glaucescent; leaves 6 to 15 cm. long; leaflets 1.5 to 2 cm. long, 5 to 6 mm. wide, oblong, 10 to 20-jugate; flowers variegated, racemose; calyx segments 11 mm. long, 4 mm. wide; petals 10 to 12 mm. long; legume 5 to 15 cm. long, 1.5 to 2 cm. wide, 1 to 4-seeded.

Seemingly wild, also cultivated, in woods near Bayamon; near Aibonito at Cari-Blanco; near Peñuelas; near Mayaguez; near Rincon, in mountain forests around Hacienda Nieve.—Bahama (Hitchcock), Cuba (Richard), Jamaica, Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Martin (Stockholm Herbarium), St. Bartholomew (do.), Guadeloupe, Martinique, St. Vincent, Bequia (Kew Bull. no. 81, p. 249), Mustique (do.), Margarita.

The tamarind, the only species of the genus, valued on account of the acid pulp of the fruit, would appear to be truly indigenous in tropical Africa. It is widely diffused either under cultivation or naturalized, through the Tropics of both the New and the Old World. According to Grosourdy (cited by Cook and Collins, p. 248) the wood is of good weight and more than ordinarily hard. The texture is rather compact and the grain fine.

Local name, *tamarindo*

18. BAUHINIA L.

Bauhinia L. Sp. Pl. **1**: 374. 1753.

Flowers hermaphrodite, more rarely polygamous; calyx with a short turbinate or tubular receptacle, before anthesis undivided and closed at the top or contracted beneath the top and shortly 5-lobed, at anthesis variously divided, vaginate or with 3 to 5 valvate, rarely imbricate, segments; petals 5, usually subequal, more rarely the uppermost differing in form from the others, imbricate in estivation; stamens 10, all fertile, with free or more or less connate filaments and dorsifixed anthers, or reduced to 1 to 9 staminodia, or entirely wanting; ovary sessile or stipitate, rarely glandular below, 2 to many-ovulate; style filiform, often very short, usually long; stigma terminal, dilated and obliquely peltate or inconspicuous; legume oblong or linear, straight, oblique, or curved, membranous, coriaceous, or almost fleshy, continuous or pulpy between the seeds, seldom septate, indehiscent or 2-valved; seeds compressed, albuminous, subglobular or ovate; seed coat thin or hard; root short and straight, rarely oblique or slightly curved.—Trees or erect or scandent shrubs, unarmed, or with interstipulary prickles, and with round or unequally compressed or broadened and flat trunk and often with branches that are transformed into tendrils; leaves simple, sometimes entire, sometimes 2-lobed or parted, more rarely 2-foliolate; stipules varying, caducous; flowers 2 or 3 together on leaf-opposed or terminal peduncles or collected in simple or compound corymbs, racemes, or panicles, white or rose to purple and yellow.

The three species of Bauhinia found in Porto Rico are trees or shrubs, with 2-lobed leaves. The calyx is closed at the top or contracted beneath the top and shortly 5-lobed, and at anthesis is vaginate. In the section Pauletia, embracing two of the species, there are 5 to 10 fertile stamens. In Casparia, containing the third, there is but 1 fertile stamen. The legume is straight, linear, coriaceous, continuous, 2-valved. Both axillary and terminal racemes occur.

KEY TO THE SPECIES.

Fertile stamens 10 or 5. (Section Pauletia.)
  Petals narrow, linear; stamens 5. 1. *Bauhinia pauletia.*
  Petals obovate or obcordate; stamens 10. 2. *Bauhinia tomentosa.*
Fertile stamens 1, the rest without anthers. (Section Casparia.) 3. *Bauhinia kappleri.*

1. **Bauhinia pauletia** Pers.

(Urban, 271.)

Erect or scandent shrubs 3 meters high, armed, leaves suborbicular or quadrate, 5 to 8 cm. long and wide, glabrous above, pubescent beneath; petiole 1 to 2.5 cm. long; calyx lobes 10 to 14 cm. long; petals narrowly linear, 5 to 8 cm. long, 1 to 1.5 mm. wide; legume 15 to 25 cm. long, 1 to 1.5 cm. wide, subtomentose; flowering and fruiting in January and February.

In the copse near Mayaguez; near Cabo Rojo; near Guanica, between La Plata and Sabana Grande near Limon.—Mexico, Nicaragua, Panama, Venezuela. West Indies, Trinidad, in shady woods near Arima.

Local names, *mariposa*, *araña gato.*

2. **Bauhinia tomentosa** L.

(Urban, 271.)

Shrub 1 to 4 meters high; leaves cordate, usually 7-nerved, membranous, 3.75 cm. to 7.50 cm. in diameter, bilobed to one-half or one-third its length, glabrous above, paler or somewhat glaucous, minutely tomentose-pubescent or glabrate beneath, the lobes rounded above and below; calyx limb spathaceous; petals obovate or obcordate, 2.50 to 6.25 cm. long, subsessile or shortly clawed, venation divergent, not prominent, pale yellow, posterior one pale purple, with a reddish, nearly black, spot at the base.

Cultivated and also seemingly wild, near Fajardo on waysides; near Mayaguez.—Jamaica, Haiti, St. Thomas, St. Croix, Guadeloupe, Martinique, Trinidad. Native country, southeastern Asia, tropical Africa.

3. **Bauhinia kappleri** Sagot.[a]

(Urban, 271.)

Tree or shrub 10 to 15 meters high; leaves ovate or orbicular, 8 to 12, sometimes 18 cm. long and wide, truncate or subcordate at the base, 11 to 13-nerved, unarmed; petioles 3 to 6 cm. long; calyx 2 cm. long; petals obovate, 5 cm. long, 2 to 2.5 cm. wide; flowers very large, showy, whitish, rose color, or yellow, with purple lines in lax racemes.

Cultivated and seemingly spontaneous, near Bayamon; near Fajardo; near Naguabo; around Hacienda Oriente; near Adjuntas at Saltillo; near Peñuelas at La Cueva; near Cabo Rojo on Mount Buena Vista; near Mayaguez; near Manati on calcareous mountains; near Rio Arriba around dwellings.—Cuba, Jamaica (Hitchcock), Haiti, St. Thomas, St. Croix, St. Kitts, Guadeloupe, Martinique, St. Vincent, Guiana. Native country, southeastern Asia?

Local names, *flamboyán blanco*, *varietal*, *seplina.*

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[a] For illustration see Cook and Collins, *pl. 19*, facing p. 90.

19. CASSIA L.

Cassia L. Sp. Pl. **1**: 376. 1753.
Senna Tourn.; Mill. Gard. Dict. ed. 8. 1768.
Bactyrilobium Willd. Enum. 439. 1809.
Chamaefistula G. Don, Hist. Dichl. Pl. **2**: 451. 1832.

Calyx with a very short receptacle and 5 imbricate segments; petals 5, imbricate, spreading, subequal or the anterior larger; stamens sometimes 10, all perfect and subequal, or the anterior shorter, or the three anterior very small, abortive, or wanting, sometimes only 5; filaments very short or elongated, rarely nodose, incrassate, or dilated in the middle; anthers uniform, or those of the anterior stamens larger, their cells dehiscing in terminal pores or in short lateral slits; ovary sessile or stipitate, free in the fundus of the receptacle, often arcuate, multiovulate, style short or elongated; stigma terminal, small, truncate, rarely ciliate or turgid; legume terete, flat, compressed, quadrangular, or alate, membranous, coriaceous, or ligneous, indehiscent, or sometimes 2-valved, with or without transverse internal septa, seldom with pulp; seeds albuminous, flattened at right angles to or parallel with the valves, rarely rhomboid-subterete, transverse, rarely longitudinally disposed in the legume; cotyledons ovate or oblong, plane, sometimes sinuous. Trees, shrubs, or herbs; leaves paripinnate, rarely wanting or reduced to small squamae; stipules various; glands of the common petiole sessile or stipitate, verrucose, hypocrateriform, scutellate, near the base or interpetiolular; flowers yellow or red, in axillary or terminal racemes, corymbs, or fascicles; occasionally solitary or geminate in the axils.

KEY TO THE SPECIES.

Perfect stamens usually 7, the 3 anterior with long curved filaments, often dilated beyond the middle, and ovate or elliptical anthers, not exceeding 4 to 6 mm. in length, dehiscing longitudinally; the 4 to 6 intermediate filaments much shorter, erect, dehiscing by means of pores; the remaining anthers 3, 2, or 1, much smaller, often sterile; legume elongated, pendulous, terete or slightly compressed, indehiscent or rarely dehiscent, divided by transverse partitions into numerous 1-seeded cavities; seeds horizontal, flattened at right angles to the axis of the legume. (Subgenus and Section Fistula DC.)

  Leaflets 4 to 8-jugate, ovate or ovate-lanceolate, 7 to 12.5 cm. long, 4 to 7 cm. wide, subacuminate, glabrous; petiolules rather long; legume round, 30 to 60 cm. long, levigate. 1. *C. fistula.*

  Leaflets 10 to 20-jugate, oblong, 3.5 to 5.5 cm. long, 2.5 cm. wide, obtuse at both ends, both surfaces pubescent; petiolules short; legume compressed-cylindrical, 45 to 60 cm. long, venose-rugose. 2. *C. grandis.*

Perfect stamens usually 7, the 2 or 3 anterior somewhat longer, the anthers linear curved, 6.5 to 13 mm. long, opening at the top by 1 or 2 pores, rarely dehiscing longitudinally; staminodia usually 3; valves not elastic, the legume rarely indehiscent. (Subgenus Senna Benth.)

  Legumes round, turgid or slightly compressed; seeds transverse, horizontal; leaves interglandular or eglandular. (Section Chamaefistula DC.)

    Leaflets 2-jugate. 3. *C. quinquangulata.*

Leaflets 3 to 5-jugate.

Leaflets small, 2 to 3.5 cm. long, obtuse at both ends.

Leaflets usually 3 or 4-jugate, obovate or oval-roundish, rounded at the top, glands between the leaves; racemes few-flowered; pedicels 3 to 6 mm. long; legume coriaceous, dehiscent along the sutures. 4. C. ***bicapsularis***.

Leaflets usually 5-jugate, oval or elliptical, rounded at the top, a gland between the lower leaves; racemes long and many-flowered; pedicels 2 to 3 cm. long. 5. C. ***stahlii***.

Leaflets large, ovate-oblong or ovate-lanceolate, acuminate, 5 to 8 cm. long; petiole with oblong glands between the leaflets; legume terete. 6. C. ***laevigata***.

Legume flattened-compressed, membranous, bivalved, convex; seeds compressed parallel to the dissepiments; petiole with obtuse glands near the base. (Section ONCOLOBIUM Vog.)

Leaflets 4 or 5-jugate, ovate or elliptic lanceolate, 2.5 to 5 cm. long. 7. C. ***occidentalis***.

Legume compressed-tetragonal, linear; seeds compressed parallel to the valves, their larger diameter likewise parallel to the valves. (Section PROSOSPERMA Vog.)

Leaflets 2 or 3-jugate, obovate or obovate-oblong, 1.5 to 5 cm. long; legume 10 to 20 cm. long, 4 to 6 mm. wide. 8. C. ***tora***.

Legume flat-compressed, bivalved; seeds compressed parallel to the valves, with their longer diameter transverse to them. (Section CHAMAESENNA DC.)

Legume winged with a broad longitudinal wing on each valve; leaves 30 to 60 cm. long; leaflets 9 to 12-jugate, oblong, truncate at the subsessile base, 7.5 to 17.5 cm. long; petiole 3-angular, eglandular. 9. C. ***alata***.

Legume not winged.

Leaves very small; leaflets 5 to 15-jugate, obovate-oblong, ciliate on the margins, otherwise glabrous; leaves fasciculate at the nodes; legumes narrow. 10. C. ***polyphylla***.

Leaves much larger, pilose; leaflets 3 to 5-jugate, rarely 2-jugate, broadly oval-oblong, very obtuse, upper surface pubescent, lower surface tomentose, eglandular; legume coriaceous, linear, straight, glabrous, tumid at the margins. 11. C. ***emarginata***.

Stamens 10 or fewer, all perfect, similar and but slightly unequal (rarely 2 or 3 abortive); anthers linear; pedicels solitary, in pairs or fascicles, axillary or superaxillary; common peduncle very short; legumes flat, linear, elastic, 2-valved. (Subgenus LASIORHEGMA Vog. Section CHAMAECRISTA DC.)

Leaflets 1-jugate, oblique, semiorbicular or semiobovate, flabellate-nerved; petiole glandular; peduncle one-flowered; legume hairy with adpressed down. 12. C. ***diphylla***.

Leaflets multijugate, very small.

Leaves subcoriaceous; leaflets 6 or 7, rarely 5 to 11-jugate, oblique, oblong-linear, rounded at the top, 8 to 15 mm. long, 2 to 4 mm. wide, glandular; peduncle 1 or 2-flowered; legume linear, hairy. 13. *C. portoricensis.*

Leaves membranous.

Glands stipitate; leaves obtuse or subacute; costa usually in the middle.

Leaves large, 7.5 cm. long; leaflets 1.1 cm. long, 2 mm. wide; common petiole and legume thinly clothed with white hairs; legume 4.5 cm. long, 5 mm. wide. 14. *C. glandulosa.*

Leaves small, 2.5 cm. long; leaflets 5 mm. long, 1 mm. wide; common petiole and legume glabrous; legume 2.5 cm. long, 3 mm. wide. 15. *C. mirabilis.*

Glands sessile or shortly stipitate; leaves narrower, mostly acute; costa more eccentric. 16. *C. nictitans.*

1. **Cassia fistula** L.

(Urban, 272.)

Tree 7 to 20 meters high; flowers in lax drooping racemes, yellow, large; pedicels long; calyx segments oval or oval-oblong, 1 cm. long, obtuse; petals ovate, 2 to 2.5 cm. long; legume pendulous. Flowering in June, fruiting in January.

Cultivated and seemingly wild near Bayamon; in the Sierra de Luquillo, on the lower slopes of Mount Jimenez near dwellings; near Mayaguez, at Algarrobo.—Cuba (Grisebach), Jamaica, Haiti, St. Croix (Eggers), St. Bartholomew (Euphrasén), Gaudeloupe, Martinique, St. Vincent, Bequia (Kew Bull. no. 81, p. 248), Trinidad, Margarita. Tropical Asia, frequently planted, but also truly indigenous; in tropical Africa cultivated or escaped from cultivation and possibly indigenous; in America only where planted.

Cassia fistula and *C. grandis* are closely related. Both are noticeable on account of their long simple racemes. *C. fistula* differs from other Porto Rican Cassia species in its very large leaves and in its long pendulous legumes. The latter are cylindrical in form and contain a dark brown, soft, agreeable-tasting pulp that has a slightly purgative action. This fruit, called "manna," is considered a delicacy, especially by children. The bark furnishes a black dye, and is employed in tanning leather, while the wood is valuable for many purposes.

Local name, *cañafistula.*

2. **Cassia grandis** L. f.

(Urban, 272.)

Tree 15 to 20 meters high; flowers in drooping, axillary rusty-pubescent racemes; calyx segments rather wide, 6 to 8.5 mm. long, obtuse; petals suborbicular, 1 cm. in diameter; legume 45 to 60 cm. long, transversely rugulose.

Indigenous and cultivated, near Peñuelas at Tallaboa Alta; near Yauco, on declivities on the banks of the Duey River at Mount Rodadero; near Mayaguez; near Vega Baja.—Cuba (Richard), Jamaica (Bentham), Haiti, St. Thomas (Eggers), St.Croix (do.), Guadeloupe. Central America, Ecuador, New Grenada, Surinam, San Domingo, Jamaica, and perhaps North Brazil.

This differs from *C. fistula*, the only other species in Porto Rico belonging to the subgenus and section Fistula DC., in the rusty pubescence of its racemes, and in its much smaller, multijugate leaflets.

The natives make from the leaves, seeds, and roots of *C. grandis* and *C. occidentalis* various medicaments. Grosourdy (cited by Cook and Collins, p. 108) says that the wood of this tree is handsome, strong, and very resistant, of ordinary weight and hardness, fibrous in texture and fine-grained.

Local name, *cañafistula cimarrona.*

3. **Cassia quinquangulata** L.

(Urban, 272.)

Shrub 2.5 to 3 meters high or a small tree about 10 meters high; branches angular; leaflets 2-jugate, obliquely ovate, shortly and obtusely acuminate, 7.5 to 10 cm. long, the lower sometimes smaller, shining above, yellow-pubescent beneath, the glands slender, between each pair of leaflets; flowers in short racemes, usually arranged in a terminal panicle; sepals ovate, petals 1.2 to 1.6 cm. long.

Flowers from September to December.

Near Bayamon in a copse; Sierra de Naguabo, on slopes along the Rio Blanco; near Juncos, on Mount Florida; near Hato Grande, on Mount Gregorio; between Gurabo and Caguas; near Aibonito, at La Lima; near Maricao, in mountain forests.—St. Thomas, St. Kitts. Guiana, Brazil.

4. **Cassia bicapsularis** L.

(Urban, 273.)

Shrub 2 to 3.5 meters high; leaves 6 to 9 cm. long; leaflets 3 to 4 cm. long, 1 to 2 cm. wide; sepals membranous, obtuse, 8 to 11 mm. long; petals yellow, 1.7 to 1.9 cm. long; legume erect or somewhat curved, 9 to 15 cm. long, 1 to 1.5 cm. wide.

Near Fajardo in thickets on the coast; near Peñuelas; near Yauco, on Mount Duey; on calcareous mountains near Cabo Rojo; near Mayaguez.—Bermuda (introduced, Hemsley), Bahama (Grisebach), Cuba (Richard), Jamaica, Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Bartholomew (Stockholm Herbarium), Antigua (Grisebach), Guadeloupe, Dominica (Grisebach), Martinique, St. Vincent, Mustique (Kew Bull. no. 81, p. 248), Barbados, Grenada, Curaçao. Tropical and subtropical South America, very common, extending from south Brazil to Central America; frequently sent also in collections from tropical Asia, but there only in cultivation. Madeira.

Local names, *sen del pais, hoja de sen.*

5. **Cassia stahlii** Urb.

(Urban, 273.)

Shrub 2 to 4 meters high; leaflets 5-jugate, the upper oval or elliptical, 2.5 to 3 cm. long, 1 to 1.5 cm. wide, the lower orbicular-oval, 1 cm. long; glands of the common petiole interpetiolular, oblong-linear; racemes long and many-flowered; flowers purple-veined; sepals 6 to 7 mm. long; petals 10 to 13 mm. long; legume erect, 12 to 15 cm. long, 1.5 cm. wide, linear.

In mountain forests between Guayama and Guamani; near Cayey, on the river Morillos; near Aibonito, at La Lima. Indigenous.

C. stahlii resembles in habit the closely related species *C. bicapsularis*, but differs from it in its longer inflorescence, much longer pedicels, and 5-jugate leaflets.

6. **Cassia laevigata** Willd.

(Urban, 273.)

Shrub 2 to 3 meters high, glabrous; leaflets 3 or 4-jugate, ovate-oblong to lanceolate, 5 to 8 cm. long, 2 to 3 cm. wide; common petiole 10 to 12.5 cm. long, channelled, with oblong or cylindrical interpetiolular glands; basal glands none; flowers in axillary or terminal racemes; calyx 6 mm. long, petals 1.6 cm. long; legumes erect, thinly coriaceous or chartaceous, obtuse, apiculate, 7.5 to 8 cm. long, 1.2 cm. wide, tardily dehiscent into 2 valves; seeds horizontal, shining.

Near Juncos on Mount Florida; near Adjuntas, in the river valley at La Galsa and on Mount Cienega at La Lucia; near Utuado; near Maricao, on Mount Alegrillo.—Jamaica, Martinique (cultivated). Tropical and subtropical America, chiefly in waste and cultivated places. Brazil, Guiana, Colombia, Central America, Mexico, and also in similar situations in tropical Asia, west Africa, and Australia, probably in most places introduced.

Like other common weeds of cultivation, this is a variable species, but it is always readily recognized by its acute or acuminate glabrous leaflets, with glands between all the pairs, or all but the terminal. *Cassia laevigata* and *C. chamaecrista*, in their respective habitats, are used as a substitute for the genuine senna leaves, folia sennae.

Local names, *sen del pais*, *yerba hedionda macho*.

7. **Cassia occidentalis** L.

(Urban, 273.)

Stem firmly herbaceous or woody below, annual of 2 or 3 years' duration, erect, a few feet in height often forming dense bushy masses; leaflets 4 or 5-jugate, ovate or elliptic-lanceolate, 5 to 7 cm. long, 2 to 2.5 cm. wide; common petiole without interpetiolular glands, but with a short obtuse gland near the base, black when dry; flowers in short few-flowered axillary racemes or fascicles; sepals obtuse, 6 to 8.5 mm. long, glabrous; petals obtuse, 1.5 cm. long; legume linear, compressed, 7 to 11 cm. long, 6 to 8 mm. wide, 2-valved, rather coriaceous, margined with straight sutures.

Near Bayamon; near Maricao, in pastures; near Mayaguez.—Bermuda (introduced, Hemsley), South Florida (Chapman), Bahama (Hitchcock), Cuba, Jamaica, Cayman (Hitchcock), Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Martin (Stockholm Herbarium), St. Bartholomew, Martinique, St. Vincent, Bequia (Kew Bull. no. 81, p. 249), Barbados, Grenada, Tobago, Trinidad (Grisebach), Margarita. Tropical America, Asia, and Africa; very abundant in waste and cultivated places. Probably of American origin; not yet received from Australia.

The foliage and inflorescence of this species are generally nearly those of *C. laevigata*, except as to the gland, which is always below the lower pair of leaflets, and usually very near the base of the petiole, not between the leaflets.

The root of *Cassia occidentalis*, cortex fedegozo, is a valued remedy for intermittent fever, and by the American Indians is thought to be an antidote against various poisons. Seeds and leaves are both used medicinally. In the West Indies the negroes apply the leaves smeared with grease in cutaneous diseases of men and of animals. The roasted seeds, known as Sudan coffee, are used as a substitute for coffee.

Local name, *hedionda*.

Cassia ligustrina L. (*C. occidentalis* variety *glabra* Stahl) is cultivated in gardens near Bayamon and Manati. It is native in Bahama, Cuba, Jamaica, and Haiti.

8. **Cassia tora** L.

(Urban, 274.)

Stem annual, erect or ascending 0.75 to 1 meter high; leaflets 2 or 3-jugate; obovate or obovate-oblong, varying from 1.5 to 3.5 or 5 cm. in length; common petiole with conspicuous narrow-cylindrical glands between at least the lower pinnae; flowers usually in pairs or solitary, axillary, with or without a short common peduncle; sepals 6 to 8 mm. long; petals 13 to 17.5 mm. long; legumes elongate, curved, narrow-linear, 10 to 20 cm. long, 4 to 6 mm. wide, dehiscent; seeds arranged lengthwise.

Near Bayamon; near Cabo Rojo around Hacienda Carmelita; near Mayaguez at the fortress.—Bahama (Hitchcock), Cuba (Grisebach), Jamaica, Haiti, St. Thomas. St. Croix (Eggers), Guadeloupe, Martinique, St. Vincent, Bequia (Kew Bull. no. 81. p. 249), Barbados, Grenada, Tobago, Trinidad. Tropical and subtropical America, Asia, Africa, and Australia, generally common in cultivated and waste places; in the United States extending as far north as Virginia, Indiana, and Arkansas.

This plant is striking on account of its narrow linear curved legumes, which are oblong-quadrate in section. The young leaves, in spite of their disagreeable odor, are used as a vegetable, while both the leaves and seeds constitute a valuable remedy in skin diseases. The seeds when roasted and ground are said to yield a decoction which is reported to be in every respect as good as coffee.

Local name, *dormidera*.

9. **Cassia alata** L.[a]

(Urban, 275.)

An erect glabrous or subglabrous shrub, 2 to 4 meters high; leaves 30 to 60 or 90 cm. long, rachis acutely margined above when dry, glandular, with a prominent transverse ridge connecting the opposite leaflets; leaflets 9 to 12-jugate, upper larger leaflets obovate-elliptical, 7.5 to 17.5 cm. long, firmly membranous; flowers light yellow, in axillary or terminal racemes; sepals 1 cm. long; petals obovate, 1.5 to 1.9 cm. long, the claw 2 to 3 mm. long; legume 2-valved, coriaceous, 12.5 to 15 cm. long, 1 to 2 cm. wide, each valve with a very prominent crenate longitudinal wing extending its entire length and incurved toward the ventral suture.

Wild and cultivated, near Bayamon, in gardens; near Coamo, in the valley of El Fuerte River; near Maricao, on the bank of the river near Mayaguez.—Cuba, Jamaica, Haiti, St. Thomas (Grisebach), St. John, St. Croix (Eggers), Guadeloupe, Martinique, St. Vincent, Grenada. Widely spread in the Tropics of both hemispheres, though probably indigenous only in America.

This is the only Cassia species in Porto Rico in which the legume is winged. The large leaflets connected by a transverse ridge make it easily recognized. From the leaves, especially in Java and South America, is made a remedy used in skin diseases and they were formerly officinal under the name of folia cassiae herpetica.

Local names, *talantala*, *talantro*.

10. **Cassia polyphylla** Jacq.

(Urban, 274.)

Shrub 2 to 4 meters high or tree 15 meters high; leaflets 5 to 15-jugate (often 10 to 12-jugate), minute, 4.5 to 6.5 mm. long, 3 to 4 mm. wide; flowers solitary in the axils of the leaves; sepals 7 mm. long; petals 1.7 cm. long; pedicels 1.5 to 2 cm. long, slender; legume 15 cm. long.

Near Guayama; near Coamo, at San Ildefonso and on the declivities of Mount Santana; along roads between Aibonito and Coamo; near Ponce, at Peñon; near Juana Diaz, at Escalabrado; near Guanica, in littoral thickets; near Salinas de Cabo Rojo, in the seashore woods of Mount Juliana.—Haiti, St. Thomas, St. Croix. Tropical America.

This differs from all the other Porto Rico Cassia species in its small fasciculate leaves and its minute leaflets.

11. **Cassia emarginata** L.

(Urban, 274.)

Shrub 3 to 10 or tree 15 meters high; leaflets 2 to 6 cm. long, 1.5 to 3 cm. wide, flowers golden yellow, in racemes which are solitary or fasciculate in the axils of the leaves; sepals 4 to 6.5 mm. long; petals 6.5 to 11 mm. wide; legume 17 to 30 cm. long, 0.6 to 1 cm. wide.

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[a] For illustration see Cook and Collins, *pl. 39*, facing p. 159 (as *Herpetica alata*).

Near Coamo, in thickets between Serillos and Salinas and toward Baños and in woods on Mount San Ildefonso; between Salinas and St. Isabel.—Cuba, Jamaica, Haiti, Guadeloupe, St. Vincent (Grisebach), Margarita. Colombia, Central America.

12. **Cassia diphylla** L.[a]

(Urban, 275.)

Annual, suffrutescent, glabrous, 0.33 to 1 meter high; leaflets 1.5 to 2.5 cm. long, 0.8 to 1.25 cm. wide; stipules large, very acute, scarious; sepals 6.5 to 13 mm. long; petals shorter than the sepals; legume 3 to 5 cm. long, 6 mm. wide; seeds oblong, oblique to the margins of the legume.

Near Bayamon, on declivities toward Toa Baja; near Santurce; near Humacao, on grassy declivities at Buenavista; near Salinas de Cabo Rojo, on the seashore and on Mount Juliana; near Rincon, in rocky places on the mountains; near Aguada, in fields at Piedra Blanca; near Manati, around the lagoon of Tortuguero in sandy districts near Campo.—Cuba, Haiti, St. Kitts (Grisebach), St. Vincent. Tropical America: from Brazil to Central America and Mexico.

Cassia diphylla is easily recognized, as it is the only Porto Rican Cassia species with but one pair of leaflets.

Local names, *hediondilla*, *zarzabacoa.*

13. **Cassia portoricensis** Urb.[b]

(Urban, 275.)

Small shrub, 0.25 to 0.60 meters high; leaflets 8 to 15 mm. long, 2 to 4 mm. wide; stipules lanceolate, acuminate; inflorescence 1 or 2-flowered; sepals lanceolate or ovate-lanceolate, 6.5 to 8 mm. long; petals obovate or orbicular-obovate, 12 to 15 mm. long, short-clawed; stamens 8.

Cassia portoricensis callosa Urb.

(Urban, 275.)

Leaflets on the margin callose-incrassate, glabrous or subpilose; inflorescence usually 2-flowered.

Near Guayanilla, on calcareous mountains near Peñon; near Mayaguez.

Local name, *retama.*

Cassia portoricensis granulata Urb.

(Urban, 275.)

Shrub 0.3 to 1 meter high; leaflets not callose on the margin, pilose; inflorescence 1-flowered.

Near Ponce, on the harbor; near Salinas de Cabo Rojo, in forests of the seashore; near Guanica, in thickets on Mount El Maniel and in salty places on the seashore. Indigenous.

Local name, *escobilla.*

This species is distinguished from the related species by its subcoriaceous, oblique leaves.

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[a] Cook and Collins, p. 112, as *Chamaecrista diphylla.*

[b] Cook and Collins, p. 113, as *Chamaecrista portoricensis.*

14. **Cassia glandulosa** L.[a]

(Urban, 276.)

A herbaceous or suffrutescent plant 0.5 to 1.5 meters high; leaves 5 to 8 cm. long; leaflets oblong-linear, membranous; peduncle 1 to 3-flowered; sepals 1 cm. long; petals 1.5 to 2 cm. long, yellow; stamens red; legume 3 to 6 cm. long, 5 to 6 mm. wide.

In sandy districts near Bayamon; Sierra de Naguabo, on the rocks on Mount Piedra Palada and on the banks of the Rio Blanco; between Aibonito and Algarrobo, along roads; between Aibonito and Coamo, on precipices; near Utuado, on declivities at Pellejas and at Mameyes and in rocky districts at Los Angeles; near Sabana Grande, on the banks of the River Estero; near Arecibo.—Cuba (Richard), Jamaica, St. Croix, St. Martin (Stockholm Herbarium), Guadeloupe, Dominica, Martinique, St. Vincent, Bequia (Kew Bull. no. 81, p. 248), Barbados, Grenada, Trinidad (Grisebach).—Tropical South America: Brazil, Guiana, Colombia.

Cassia glandulosa has often (as by Linnaeus himself) been confounded with other species, but it can be distinguished from *Cassia chamaecrista* in that its petiole bears a stipitate gland between the lowest pair of leaflets (and sometimes several below the upper pairs) and in that the pairs of leaflets are usually much more numerous. *Cassia chamaecrista* has sessile depressed glands.

Local name, *tamarindillo*, *hediondilla*.

15. **Cassia mirabilis** (Poll.) Urb.

(Urban, 276.)

Stem suffrutescent, glabrous; leaves pinnate, 2 cm. long; petiole 1.5 cm. long, with two stipitate glands; leaflets 10 to 17-jugate, 5 mm. long, 1 mm. wide, oblong, rounded at both ends, papyraceous, glabrous on both sides, shortly petiolulate, mucronate; stipules lanceolate, acuminate, 3 mm. long; flowers yellow; legumes 2 to 2.5 cm. long, 3 mm. wide, brown, glabrous, papyraceous, apiculate.

Near Manati, in sandy soil on the edge of Tortuguero Lagoon at Campo Alegre; between Manati and Vega Baja in sandy soil; near Dorado, in the meadows of the coast.

16. **Cassia nictitans** L.

(Urban, 276.)

Annual, herbaceous or suffrutescent, pubescent, with curved hairs, or glabrescent; leaflets 12 to 25-(rarely 5-) jugate, 0.4 to 1 cm. long, oblong-linear, mucronulate, slightly oblique at the base, penninerved, striate with veins; petiole bearing a stipitate gland below the lowest pair; stipules exceeding the insertion point of the gland, acuminate from a lanceolate, oblique base; peduncle 1-(to 3-) flowered, much exceeded by the leaves; stamens 5 to 7 (or even 10); legume bearing scattered curved hairs; petals 0.6 to 0.8 cm. long.—Variable in the petiolar glands, which are long-stipitate or subsessile.

Near Bayamon; near Santurce; near Juncos, on Mount Santo de Leon; near Maunabo, at Punta de la Tuna; near Aibonito, on precipices toward Coamo; near Coamo, in meadows between Serillos and Salinas; between Peñuelas and Tallaboa Alta, on the roadside; near Sabana Grande, on the bank of the Estero River; near Guanica, in thickets on the seashore at Caño Gordo; near Mayaguez; near Maricao, in pastures; near Rincon, in the mountains at Calvache.—Bahama, Cuba, Jamaica, Haiti, St. Thomas, St. Kitts, Guadeloupe, Martinique, St. Vincent, Margarita, Curaçao, Mexico, subtropical and temperate North America.

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[a] Cook and Collins, p. 113, as *Chamaecrista glandulosa*

20. KRAMERIA Loefl.

Krameria Loefl. Iter Hisp. 195. 1758.

Calyx with 4 or 5 subequal, imbricate, more or less corollaceous segments, the outer one somewhat larger than the others; petals 4 or 5, narrower than the calyx segments, the upper ones subequal, long-clawed, sometimes free, sometimes connate, the middle one often folded, the 2 lower ones reduced to thick, short, fleshy scales; stamens 3 or 4, hypogynous, the anthers basifixed, opening by an oblique introrse pore; ovary sessile with 2 collateral, hanging, anatropous seeds; style cylindrical, pointed; legume globose or somewhat compressed, aculeate or weakly spinous, indehiscent; seeds exalbuminous.—Shrubs or herbs, often decumbent and silky-tomentose; leaves simple or rarely digitate (leaflets 3); flowers purple, axillary, sometimes in leafy racemes; bracts 2, at or above the middle of the peduncle; filaments free, or connate half their length.

1. Krameria ixina L.

(Urban, 277.)

Plant 0.5 to 1 meter high; stem erect, branched, woody below, villous-pubescent; leaves elliptical-lanceolate, mucronate; flowers racemose, purple or dark purple; pedicels short, bibracteolate about the middle; sepals 4, pubescent externally; posterior petals connected at the base; stamens 4; spines of pericarp glochidiate.

Between Ponce and Guayanilla, on calcareous rocks of the coast; near Ponce, on the harbor and at Peñon; near Guanica, in littoral thickets at Salinas and on the declivities at Punta de los Pescadores; near Cabo Rojo, in forests near the seashore.—Haiti, St. Thomas, Antigua (Grisebach), Curaçao (Vahl), Colombia.

21. PARKINSONIA L.

Parkinsonia L. Sp. Pl. **1**: 375. 1753.

Calyx with a short receptacle and 5 subequal, membranous, slightly imbricate segments; petals 5, nearly equal, the posterior one the widest; stamens 10, their filaments villous at the base; ovary free, in the fundus of the receptacle, substipitate, multiovulate; style filiform; stigma small, terminal; legume narrowly linear, narrowed to each end, usually constricted between the subdistant seeds, scarcely or not at all dehiscent; valves thinly coriaceous, longitudinally reticulate-striate; seeds oblong, longitudinally disposed, albuminous.—Trees or shrubs with thorny stipules; leaves bipinnate; common petiole very short, spine-pointed; pinnae 2 to 4, with the rachis much elongated, flattened, bearing numerous, opposite or scattered, very small leaflets, which are occasionally abortive; flowers yellow, in lax axillary racemes; bracts small, caducous; bracteoles wanting.

1. Parkinsonia aculeata L.

(Urban, 277.)

Small trees or shrubs; common petiole only 1 to 2 mm. long; pinnae 1 or 2-jugate; secondary petioles winged, linear, acuminate, 16 to 36 cm. long; leaflets minute, oblong or obovate, 4 to 5 mm. long, 1 to 2 mm. wide, blunt, the uppermost (or many) abortive; flowers yellow, in lax axillary racemes, 9 to 16 cm. long; calyx 7 mm. high; corolla suborbicular, 1 cm. in diameter; legume 8 to 9 cm. long, 1 cm. wide, constricted between the seeds.

Near Fajardo on the seashore between Guayama and Guamani along roads; near Mayaguez; near Quebradillas.—Florida Keys, Cuba, Jamaica, Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Martin, St. Bartholomew (Stockholm Herbarium), Antigua, Guadeloupe, Martinique, St. Vincent, Bequia, Cannouan (Kew Bull. no. 81, p. 248), Union (do.), Barbados (Grisebach), Grenada, Trinidad (Grisebach), Margarita. Tropical and subtropical regions of both hemispheres. In the Old World, however, it is a cultivated plant.

From the bark and leaves is made a medicament used in all wasting diseases; from the flowers and seeds another used for intermittent fever. The bast is employed in the manufacture of paper. Its whitish, close-grained wood is used for fuel and also makes good charcoal.

The plant is easily recognized on account of its peculiar habit. The primary petioles are very short, the pinnae extremely long and spine-pointed, the leaflets minute and sometimes almost abortive.

Local names, *palo de rayo*, *flor de rayo*. Jerusalem thorn (Cook and Collins).

22. HAEMATOXYLUM L.

Haematoxylum L. Sp. Pl. **1**: 384. 1753.

Calyx with a short receptacle; segments 5, subequal, deeply imbricate; petals 5, oblong, spreading, nearly equal, imbricate in estivation; stamens 10, free, nearly erect; filaments slightly pilose at the base; ovary subsessile, free, 2 or 3 ovulate; style filiform; stigma small, terminal; legume lanceolate, compressed, membranous, adhering at the sutures, separating lengthwise in the middle of the valves into 2 boat-shaped false valves; seeds transverse, oblong, the chalaza ventral, albuminous.—Glabrous trees, the leaves paripinnate or bipinnate, the leaflets obovate, paucijugate; stipules sometimes spinous, sometimes small and caducous; flowers yellow, small, in lax axillary racemes; bracts small, caducous; bracteoles wanting.

1. **Haematoxylum campechianum** L.

(Urban, 277.)

Tree 5 meters high, the branches white-barked, often spiny; leaves paripinnate; leaflets 3 or 4-jugate, obovate, retuse, glabrous, 1.5 to 2.5 cm. long; flowers yellow; calyx 4 mm. long; petals oblong-obovate, 6 mm. long.

Near Ponce, on the seashore; near Cabo Rojo, toward Puerta Real, on roadsides; near Mayaguez, on Mount Mesa; near Isabela, in forests near the seashore.—Bahama, Cuba, Jamaica, Cayman, Haiti, St. Thomas, St. Croix, St. John, St. Bartholomew (Stockholm Herbarium), Antigua (Grisebach), Guadeloupe, Dominica, Martinique, St. Lucia (Grisebach), St. Vincent, Bequia, Mustique (Kew Bull. no. 81, p. 248), Grenada, Tobago, Trinidad. This tree is indigenous in Mexico and in Central America. It is widely diffused, however, either under cultivation or naturalized, in the West Indies, especially Jamaica, and in the northern part of South America, as well as in some parts of tropical Asia.

From the blood-red heartwood of the tree (which becomes black on exposure to the air) is made logwood (campeachy-wood), an exceedingly valuable dyestuff. The important crystalline principle of this wood, haematoxylin ($C_{16}H_{14}O_6$), is much use as a dyestuff to produce blue, violet, and black. The most valuable logwood comes from the west coast of Yucatan, the least valuable from the Antilles. The wood is of value in cabinet work, and the bark contains a gum from which one kind of India ink, also called Chinese ink, is made. In the countries where the tree is indigenous the the bark, bast, and legumes are used by the people medicinally.

Local names, *palo de campeche*, *campeche*.

23. POINCIANA L.

Poinciana L. Sp. Pl. **1**: 380. 1753.
Poincia Neck. Elem. **2**: 449. 1790.
Delonix Raf. Sylva Tellur. **2**: 92. 1836.

Calyx with a very short turbinate receptacle, sometimes with almost none; segments 5, nearly equal, valvate in estivation; petals 5, round, imbricate, nearly equal, or the posterior one different from the others; stamens 10, free, deflexed; filaments slightly villous at the base, toward the top inflexed; ovary sessile, free, multiovulate; style filiform, stigma terminal, ciliolate, but slightly dilated; legume coriaceous, elongated, compressed, obliquely veined, 2-valved, with tissue between the seeds; seeds compressed, ellipsoidal or oblong, transversely disposed, albuminous.—Unarmed trees; leaves bipinnate; leaflets small, numerous; stipules obscure; flowers handsome, orange or scarlet, corymbose at the ends of the branches; bracts small, caducous; bracteoles wanting.

1. **Poinciana regia** Boj.; Hook.[a]

(Urban, 278.)

Tree 15 to 20 meters high; leaves 20 to 40 cm. long; pinnae 8 to 20-jugate, multifoliolate; leaflets oblong, 7 mm. long, 3 mm. wide, blunt at each extremity, upon very short petioles; flowers scarlet; calyx 2.5 cm. long; petals 5.5 cm. long, the claw 2 cm. long, the lamina orbicular, 3.5 cm. in diameter; vexillum white with a pinkish tint; legume 12 to 37 cm. long, 3 to 4.5 cm. wide.

Cultivated and seemingly wild in Fajardo on the public squares; in Cabo Rojo, in the market place; near Mayaguez.—Bahama, Haiti, St. Thomas, St. Croix, Guadeloupe (Duss), Martinique, Margarita. Native of Madagascar, but cultivated on account of its beauty on the east and west coasts of Africa, in India, and in other parts of the Tropics.

This magnificent tree, with its bright scarlet flowers and fern-like leaves, is the handsomest of the Caesalpinioideae. Wood white, light, soft, and loose-grained; takes a fine polish.

Local names, *flamboyán*, *flamboyán colorado*.

24. CAESALPINIA L.

Caesalpinia L. Sp. Pl. **1**: 380. 1753.

Calyx with short or very short receptacle; segments 5, imbricate, the lowermost one concave or boat-shaped and usually larger than the others; petals 5, orbicular, sometimes oblong, spreading, strongly imbricate, subequal or the uppermost one smaller; stamens 10, free, deflexed; filaments usually villous or glandular at the base; ovary sessile, free, the ovules few; style terete, often filiform, sometimes clavate at the top; stigma terminal, truncate or concave; legume ovoid, oblong, lanceolate or falcate, compressed, sometimes with thickened sutures, coriaceous, flat or turgid, sometimes 2-valved, sometimes indehiscent or later slightly 2-valved, often pulpy between the seeds; seeds tranvserse, ovoid or globose, exalbuminous (or albuminous in *C. pulcherrima*).—Trees or often high-climbing shrubs, unarmed or with scattered prickles; leaves bipinnate; leaflets small and numerous or large and few, membranous or coriaceous; stipules various; flowers yellow or red, often handsome, in lax simple or panicled racemes, axillary or on the ends of the branches. Bracts wanting.

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[a] For illustration see Cook and Collins, *pl. 54*, facing p. 223.

The five Porto Rican species of this genus belong to four different sections. *C. bonduc* and *C. crista* are included in section 1, Guilandina. They are aculeate, scandent shrubs with membranous leaflets and echinate legumes.

C. sepiaria belongs to section 3, Sappania. It is a prickly climbing shrub with seeds that are as long as wide, and glabrous legumes.

C. pulcherrima, a shrub with beautiful fragrant flowers, is contained in section 4, Caesalpinaria. The long-exserted anthers and small membranous leaflets are also noticeable.

C. gilliesii, worthy of notice on account of its minute leaflets and lanceolate legumes, is included in section 6, Erythrostemon.

KEY TO THE SPECIES.

Flowers rather small with subsessile bracts, in spikes; petiole with prickles; legume with prickles.
  With stipules; bracts of the pedicels horizontal, curved; seeds lead-colored. 1. *C. crista.*
  Without stipules; bracts of the pedicels erect; seeds yellow. 2. *C. bonduc.*
Flowers large, long-stipitate, without bracts, in showy racemes; legume without prickles.
  Petioles with prickles; leaves pilose. 3. *C. sepiaria.*
  Petioles without prickles; leaves glabrous.
    Flowers showy, yellow; pedicels and petioles glandular; legume glandular. 4. *C. gilliesii.*
    Flowers showy, scarlet; pedicels and petioles glabrous; legume glabrous. 5. *C. pulcherrima.*

1. **Caesalpinia crista** L.

(Urban, 278.)

Shrub, scandent, 4 meters high, aculeate; leaves bipinnate; leaflets 8 to 12-jugate, ovate to ovate-oblong, 2 to 6 cm. long, shortly and obtusely acuminate, membranous or subchartaceous; stipules conspicuous, cut into large segments; bracts beneath the buds horizontal or curved; flowers rusty yellow, calyx lobes 7 mm. long; petals ovate-oblong, 1 cm. long; legume oblique, 5 to 7.5 cm. long, 3.5 cm. wide, turgid; seeds lead-colored.

In coast districts near Bayamon; near Humacao, in copses at Punta Candelero; near Patillas, around Guardaraya; near Guanica, in thickets at Salinas; near Mayaguez at Guanajibo.—Bermuda (Hemsley), Florida Keys, Bahama, Cuba, Jamaica, Haiti, St. Thomas, St. Croix, St. John, St. Martin (Stockholm Herbarium), St. Bartholomew, Guadeloupe, Dominica (Grisebach), Martinique, St. Vincent, Mustique (Kew Bull. no. 81, p. 248), Barbados, Grenada. Tropics of Asia, Africa, and America, Australia, and New Guinea.

Every part of the plant (root, leaves, seeds, bark) is valuable medicinally. There appears to be a difference of opinion regarding the properties of the roots, but all authors agree in extolling the virtues of the seed. For making bracelets, necklaces, and rosaries the seeds are much used, and in some countries the children use them for marbles.

Local names, *mato de playa, mato azul.* Cuba, *guacalote prieto* (Law, Morales), St. Thomas, *gray nickars* (Eggers); St. Croix, *nickars* (West); Guadeloupe, *canique grise, oeil de chat* (Duchassaing, Duss); Martinique, *yeux de chat* (Duss, Hahn); Grenada, *horse-eye, quashi* (Broadway).

2. **Caesalpinia bonduc** (L.) Roxb.

(Urban, 278.)

Prickly trailing shrubs; leaves paripinnate; stipules none; primary and secondary petioles puberulous, bearing recurved prickles; leaflets 5 to 8-jugate; ovate or elliptical, shortly acuminate, subcoriaceous, 4 to 8 cm. long, 2.5 to 4.5 cm. wide; flowers yellow; bracts beneath the buds erect; legume broadly ovate-oblong, convex-compressed, prickly; seeds yellow.

Near Isabela.—Florida Keys, Cuba, Jamaica, Cayman (Cockerell), Haiti (Plumier), Florida, Mexico, Java, Sumatra, Amboina, East Indies (Baker).

Local names, *matos de playa*. Cuba, *guacalote amarillo* (Sagra & Sauv.); Jamaica, *nicker tree* (Sloane).

3. **Caesalpinia sepiaria** Roxb.

(Urban, 279.)

Shrub diffuse or trailing, 2 to 3 meters high, prickly, puberulous above; pinnae 6 to 10- (rarely 4-) jugate; leaflets 8 to 12-jugate, oblong, rounded, or subtruncate, 1 to 1.7 cm. long, 5 to 6 mm. wide, pale and puberulous or glabrescent beneath; stipules semisagittate, deciduous; petals 1.5 cm. long, slightly exceeding the calyx; filaments shortly exserted, villous below; legume flat-compressed, at length tumid, 6 to 6.25 cm. long, 1.5 cm. wide.

Cultivated and seemingly spontaneous near Bayamon; near Pepino, along roadsides; around Enea; between San German and Lajas Arriba, along roadsides; near Maricao on declivities.—Cuba, Jamaica, Haiti, Guadeloupe, Dominica, Martinique, St. Vincent, Barbados, Grenada. Introduced from the East Indies, but naturalized in all of the Antilles.

Caesalpinia sepiaria is useful for making hedges.

Local name, *zarza;* Guadeloupe and Martinique, *croc à chien*, *arrête-bœufs*, *fernambouc*, *gendarme*, *arrête-nègre*.

4. **Caesalpinia gilliesii** Wall.

(Urban, 279.)

Tree, 1 to 4 meters high, unarmed; branches at first glandular; leaves imparipinnate; pinnae 10 to 20-jugate; leaflets 8 to 15-jugate, petioles glandular, subsessile, oblong, obtuse, 4 to 8 mm. long, 2 to 3 mm. wide, membranous; racemes 15 to 30 cm. long, simple; pedicels 2 to 3 cm. long, glandular-viscous; calyx lobes oblong, 2 to 2.5 cm. long; petals broadly obovate, 2.75 to 3.5 cm. long, yellow; legume oblique, slightly falcate, compressed, glandular, 7.5 cm. long; seeds ovate.

Cultivated near Guanica. Native country, Argentina.

Local name, *espiga de amor*.

5. **Caesalpinia pulcherrima** (L.) Sw.

(Urban, 279.)

Tree, small, glabrous, 3 to 5 meters high; branches unarmed, often with a glaucous bloom; leaves bipinnate, 12 to 24 cm. long; pinnae 4 to 9-jugate; leaflets 5 to 12-jugate, obovate or oblanceolate-oblong, 1.5 to 2 cm. long, 8 to 9 mm. wide; racemes terminal and from upper axils, bearing many showy, variegated, yellow and carmine, or rarely pale yellow, flowers on long pedicels (5 to 7.5 cm.); calyx lobes glabrous, about 9 mm. long; petals usually 1 to 2.5 cm. long; legume coriaceous, flat, 5 to 9 cm. long, 1.5 cm. broad above, glabrous; seeds obovate-quadrate, compressed.

Cultivated and seemingly spontaneous near Bayamon; near Yabucoa; near Utuado, at Salto Arriba; near Mayaguez.—Florida Keys, Bahama (Dolley), Cuba, Jamaica, Cayman (Hitchcock), Haiti, St. Thomas, St. Croix, St. Martin (Stockholm Herbarium), St. Bartholomew (do.), St. Kitts, Antigua (Grisebach), Guadeloupe, Martinique, St. Vincent, Barbados (Sloane), Grenada, Tobago, Trinidad (Grisebach). The plant is also found in America, Asia, and Africa. Native country unknown.

This elegant bush remains in flower all the year. In one variety the flowers are red, in another yellow. The leaves, flowers, and seeds are largely used in native medicine.

Local name, *clavellina.* Cuba, *cuacamaya* (Sagra); Jamaica, *flower fence of Barbados or wild senna or Spanish carnation* (Sloane), *Barbados pride* (P. Brown, Macfadyen); France, *poinciade or fleurs de paradis* (Jacquin); Haiti, *poincellade* (Jäger, Buch); Danish Islands, *dudeldu* (Eggers); Guadeloupe, *baraguette* (Duchassaing, Duss); Martinique, *arrête-bœufs* (Duss); Barbados, *flower fence or Spanish carnation* (Hughes); Tobago, *dudeldu* (Eggers).

25. MYROSPERMUM Jacq.

Myrospermum Jacq. Enum. Pl. Carib. 4. 1760.
Calusia Bert.; DC. Prod. **2**: 94. 1825, as section.

Calyx inflexed-turbinate, with very short, wide, membranous teeth; standard obovate, the 4 inferior petals free, almost alike, curved, lanceolate, acute; stamens free, persistent, with long filaments and small anthers; ovary stipitate, 2 to many-seeded; style subulate, almost straight, with a small terminal stigma; pod stipitate, compressed, indehiscent, with one seed at the apex, narrowed to the base, 2-winged, the wing of the upper suture broader than that of the lower; seeds oblong.—Tree with imparipinnate leaves; leaflets with pellucid lines and dots; flowers rather large, in terminal racemes.

1. **Myrospermum frutescens** Jacq.

(Urban, 279.)

A small tree, 3 to 5 meters high or a large one 20 meters high; leaflets 5 to 7-jugate, 2 to 2.5 cm. long, membranaceous, oblong or oval, roundish, retuse or blunt at the apex, glabrous, striate with pellucid lines; flowers white, the standard striped in the middle with green; legume 5 to 7.5 cm. long (including the wing), as broad as the wing, which tapers at the base into a short stalk.

Cultivated and seemingly wild near Coamo; near Peñuelas, near Utuado, in a thicket of *Coffea arabica* at San Andres; near Mayaguez.—St. Croix (Eggers). Native country Trinidad, Central America, Colombia, Venezuela.

Local names, *cereipo, sereipo.*

26. ORMOSIA Jacks.

Ormosia Jacks. Trans. Linn. Soc. **10**: 360. *pls. 25, 27.* 1811.
Macrotropis DC. Prod. **2**: 98. 1825.

Calyx campanulate with the 2 upper teeth subconnate and usually longer and wider, often incurved; petals unguiculate; standard suborbicular or cordate; wings oblique, obovate-oblong; keel with the petals free; stamens free, unequal, all or all but one or two perfect; anthers versatile; ovary subsessile, biovulate or multiovulate; style filiform, involute at the apex; stigma introrse, lateral; pod oblong or more rarely linear, usually short, compressed, coriaceous, fleshy or woody, 2-valved, continuous or septate between the seeds; seeds obovate or oblong, rather thick, shiny, scarlet or spotted with black.—Trees with imparipinnate or abruptly pinnate leaves; leaflets coriaceous; flowers white, lilac, or blackish purple in terminal, more rarely axillary, panicles, sometimes in racemes.

1. **Ormosia krugii** Urb.

(Urban, 280.)

Tree 10 to 25 meters high; leaves 7 to 9-foliolate; petioles 20 cm. long; leaflets 7 to 15 mm. long, petiolulate, oval or oval-elliptical, obovate or ovate, rounded or truncate at the top, rounded or subtruncate at the base, 7 to 25 cm. long, 3.5 to 14 cm. wide, coriaceous, upper surface glabrous, lower surface with minute adpressed hairs; inflorescence sometimes 35 cm. long, axillary or terminal, paniculate or subcorymbose; calyx 10 mm. long, pilose; petals dark violet; standard suborbicular, 12 mm. wide, spotted with white or pale yellow; wings oblique, obovate-cuneate; keel petals free, oblique, oblong, 13 to 14 mm. long; ovary 4 to 6-ovulate; pod 10 cm. long, 2 cm. wide, constricted between the seeds; seeds suborbicular or obovate-orbicular, 10 to 12 mm. long, 6 to 9 mm. thick, carmine-red or spotted with black.

In the primeval woods near Bayamon; near Juncos, on Mount Guvuy; Sierra de las Piedras, on Mount Frances; near Yabucoa, on Mount Piedra Azul at Jácana and on Mount Cerro Gordo; near Adjuntas, on Mount Andubo and Mount Cedro; near Utuado, at Roncador; in Sierra de Lares at Guajataca.—Dominica at Castle Bruce.

Local names, *matos* or *palo de matos*, *peronia*.

27. SOPHORA L.

Sophora L. Sp. Pl. **1:** 373. 1753.

Calyx teeth short; standard obovate or orbicular, erect or spreading; wings oblong, oblique; keel oblong, nearly straight, its petals usually imbricate or coherent along the back; stamens perigynous or nearly hypogynous, free or rarely slightly connate at the base; anthers versatile; ovary short-stalked, multiovulate; style incurved; stigma minute, terminal; pod moniliform, terete or slightly compressed, coriaceous and indehiscent in our species; cotyledons thick, the radicle sometimes straight and short, sometimes longer and inflexed.—Trees or shrubs with imparipinnate leaves; leaflets sometimes small and numerous, sometimes few and large, often with stipels; flowers white, rarely a bluish-violet, in simple terminal racemes, these sometimes aggregated in panicles.

1. **Sophora tomentosa** L.

(Urban, 280.)

A robust, erect shrub, 2 to 3 meters high, the branches densely argenteous; petiole 2.5 cm. long; rachis 5 to 10 cm. long; leaflets 15 to 19, nearly sessile, oblong, 4 to 5 cm. long, slightly mucronate, the base slightly rounded, subcoriaceous, both sides densely and permanently coated with adpressed gray-silvery tomentum; flowers in lax 12 to 30-flowered axillary and terminal racemes; pedicels 0.6 to 1.2 cm. long, argenteous, with a lanceolate or linear bract at the base; calyx campanulate, 6 to 8 mm. deep, subtruncate, argenteous; corolla, bright yellow, 1.8 cm. deep; pod 12.5 to 15 cm. long, with 5 to 8 coriaceous segments 6 to 8 mm. thick, connected by narrow necks.

Near Guanica, at Salinas; near Mayaguez in coast districts toward Guanajibo.—Bermuda (Hemsley), South Florida (Chapman), Bahama (Hitchcock), Cuba, Jamaica, Haiti, St. Thomas, St. Croix (Eggers), Antigua (Grisebach), Guadeloupe (do.), Marie Galante, Martinique, St. Lucia, St. Vincent, Union (Kew Bull. no. 81, p. 248). A cosmopolitan of the Tropics, often found on the seashore.

28. CROTALARIA L.

Crotalaria L. Sp. Pl. **2**: 714. 1753.
Clavulium Desv. Ann. Sc. Nat. **9**: 407. 1826.
Maria-Antonia Parl. Mar. Ant. Nov. Gen. 3. 1844.

Calyx laciniae free or more rarely the two upper ones and the three lower ones more or less united; standard orbicular, more rarely ovate, usually callous above the short claw; wings oblong or obovate, shorter than the standard; keel incurved or angled. terminating inwards in a straight or incurved beak, rarely almost obtuse and not beaked; stamens all united in a sheath open along the upper side; anthers alternately long and erect and short and versatile; ovary sessile or distinctly stalked, with 2 or more ovules; style much incurved or suddenly bent inward, with a longitudinal line of hairs above the middle on the inner side; stigma terminal; pod round or oblong. turgid or inflated, 2-valved, continuous within; seeds with a filiform funiculus.—Herbs, shrubs, or undershrubs; leaves alternate, simple or digitately compound with usually 3, rarely 1 or 5 or 7 leaflets; stipules free from the petiole, occasionally decurrent along the stem, sometimes large and foliaceous, sometimes small, rarely wanting; flowers yellow, more rarely blue or purple, in simple racemes terminal, becoming sometimes leaf-opposed, more rarely solitary; bracteoles small, on the peduncle or adnate to the calyx tube, rarely wanting.

KEY TO THE SPECIES.

Leaves simple (Section Simplicifoliae Benth.).

Stipules foliaceous, broadly decurrent, with a semilunar, incurved top; leaves oval or oblong, sessile or subsessile; peduncle lateral, elongated, few-flowered; calyx 5-parted, usually as long as the corolla.

Peduncles reaching 10 cm.; flowers many; leaves reaching 7 cm.; pods stipitate. 1. *C. stipularia.*

Peduncles short, about 3-flowered; leaves 5 cm. long; pod subsessile. 2. *C. sagittalis.*

Stipules wanting; leaves cuneate-oblong, shortly petioled, retuse or very obtuse or faintly mucronate at the top; flowers in lax terminal, elongated, many-flowered racemes; calyx bilabiate, exceeded by the corolla. 3. *C. retusa.*

Leaves digitately trifoliolate (Section Trifoliolatae Baker).

Racemes both lateral and terminal, laxly 6 to 12-flowered, 5 to 10 cm. long, on peduncles 2.5 to 10 cm. long; corolla bright yellow; leaflets obovate or orbicular, 2.5 to 4 cm. long, the common petiole 4.5 to 5.5 cm. long; pod oblong, broad, turgid, clothed with fine spreading hairs like those of stem. 4. *C. incana.*

Flowers 1 to 4 together in the axils of many of the leaves, if more than one racemose or umbellate; corolla yellow, faintly veined; leaflets elliptical-lanceolate, 1 to 2 cm. long, 7 to 9 mm. wide, common petiole 2 to 3.5 cm. long; peduncles short, 5 mm. long; pod glabrescent. 5. *C. lotifolia.*

1. Crotalaria stipularia Desv.

(Urban, 280.)

Annual, erect, 0.33 meter high or higher; leaflets oval or oblong, 2.5 to 7 cm. long, 1 to 2.25 cm. wide, sessile, subhirsute-pubescent on both sides; peduncle 5 cm. long; flowers yellow, small; calyx 5-parted, usually as long as the corolla, fulvopilose;

segments lanceolate; corolla about 1 cm. long; legume 2.5 to 3.5 cm. long, 8 mm. wide, glabrous.

Near Bayamon along roads; near Coamo; near Mayaguez, on hills at Boquillas and in coast districts at Algarrobo.—Cuba, Haiti, St. Kitts, Guadeloupe, Dominica, Martinique, St. Vincent, Trinidad (Grisebach), Mexico. Frequent in the warmer regions of South America.

Local name, *cascabelillo.*

2. **Crotalaria sagittalis** L.

(Urban, 280.)

Annual, hairy; stem 10 to 20 (sometimes 30) cm. high, erect, branching; leaves simple, oval or oblong-lanceolate, 2.5 to 5 cm. long, pubescent with long, soft hairs, scarcely petioled; stipules occasionally wholly wanting, usually present, united and decurrent on the stem, obversely sagittate, nearly all, but especially those of the upper leaves, large, the free portion triangular-lanceolate; peduncles rather short, about 3-flowered, opposite the leaves; corolla rather shorter than the calyx; legume scarcely stipitate, coriaceous, several-seeded; seeds small, shining, black when ripe, rattling in the inflated legume.

Near Bayamon, in fields on the coast at Cataño; near Yauco on Mount Duey.—Jamaica, Haiti, North America, Mexico, and as far as Peru.

3. **Crotalaria retusa** L.

(Urban, 281.)

Annual, erect, 1 meter high; leaflets 5.5 to 7.5 cm. long, 2 to 3 cm. wide, very short-petioled, glabrous above, sericeo-canescent beneath; raceme 15 to 30 cm. long; flowers yellow, the standard variegated; calyx bilabiate, exceeded by the corolla; corolla 1.5 to 2.25 cm. long; legume 3 cm. long, 1.25 cm. wide, glabrous.

Near Bayamon along roads; near Cataño; near Cabeza de San Juan; near Maunabo, at Punta de la Tuna; near Patillas, in coast districts at Guardaraya; near Cabo Rojo in pastures; near Mayaguez, on Mount Mesa.—Bahama, Cuba, Jamaica, Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Martin (Stockholm Herbarium), St. Bartholomew (do.), St. Kitts, Guadeloupe, Dominica, Martinique, St. Vincent, Mustique, Bequia (Kew Bull. no. 81, p. 244), Union (do.), Barbados, Grenada, Tobago, Trinidad. Found in the warm regions of the globe; frequent in East India and in the Antilles.

The leaves and roots of *Crotalaria retusa* are used in popular medicine, and in Farther India it is sometimes cultivated for its fiber.

Local names, *matraca, sonajuelas;* according to Stahl (cited by Cook and Collins, p. 129), *cacsabelillo grande.*

4. **Crotalaria incana** L.

(Urban, 281.)

Annual or biennial, herbaceous, 0.66 to 1.33 meters high; branches clothed with fine spreading brown silky hairs; leaflets obovate or orbicular, 2.5 to 4 cm. long, 2 to 2.5 cm. wide, glabrescent above, slightly silky beneath; petioles 4.5 to 5.5 cm. long; flowers greenish yellow; calyx deeply 5-lobed, segments lanceolate, exceeded by the corolla; corolla 1 to 1.25 cm. long; legume pendulous, 2.5 to 3.5 cm. long, about 1 cm. wide.

Near Bayamon along roads; near Cabeza de San Juan on declivities; near Fajardo on the river bank; near Juncos along roads; near Guayama; near Cayey along roads; near Coamo on roads; near Adjuntas at Coral Viejo, near Guanica in thickets at the lagoon; near Cabo Rojo, in pastures at Miradero; near Mayaguez at the fortress and on the declivities of Mount Mesa; between Mayaguez and Añasco along roads; near Rincon in thickets on the seashore.—South Florida (Chapman), Cuba, Jamaica, Cayman

(Hitchcock), Haiti, St. Thomas, St. Croix, St. Martin (Stockholm Herbarium), St. Bartholomew (Euphrasén), Antigua (Grisebach), Guadeloupe, Dominica (Grisebach), Martinique, St. Vincent, Bequia, Mustique (Kew Bull. no. 81, p. 244), Barbados, Grenada, Tobago, Trinidad, Margarita. Cosmopolitan in the warm regions of the world, but perhaps an introduction in the Old World.

Local name, *cascabelillo vacío.*

5. **Crotalaria lotifolia** L.

(Urban, 281.)

Shrubby, diffuse, 0.5 to 2 meters high; leaves 5 to 7 cm. long, sericeous on both sides; peduncle 5 mm. long; flowers pale yellow; vexillum with red curving lines on the inner side at the base; calyx deeply 5-parted, shortly exceeded by the corolla, lobes lanceolate; corolla about 1.25 cm. long; legume spathulate-oblong, puberulous, 2 cm. long, 6 mm. wide.

Near Fajardo in shady places; near Coamo, in the woods of Mount Ildefonso and in thickets on the Juey River toward Salinas; near Guanica, in shady meadows at Montalba and in thickets on the seashore; near Salinas de Cabo Rojo at Punta de Aguila.—Cuba, Jamaica, Haiti, St. Thomas, St. Croix (Eggers), St. John; the varieties *grandifolia* and *grandiflora* in Martinique, Barbados, and tropical west Africa. A well-known very distinct West Indian species.

Local name, *cascabelillo axilar* (Cook and Collins).

29. INDIGOFERA L.

Indigofera L. Sp. Pl. **2**: 751. 1753.
Acanthonotus Benth. in Hook. Niger Fl. 293. 1849.
Sphaeridiophorum Desv. Journ. Bot. **3**: 125. *pl. 6.* 1814.
Brissonia Desv. Ann. Sc. Nat. **9**: 411. 1826.

Calyx small, oblique, campanulate or tubular, teeth equal or the lowest longest; standard obovate, oblong, or suborbicular, sessile or shortly unguiculate; wings more or less oblong, adhering a little to the keel; keel straight or slightly curved, obtuse, or acuminate, gibbous or spurred on both sides; upper stamen free from the base, the others connate; anthers uniform with glandular, apiculate or penicillate-pilose connective; ovary sessile or nearly so, with several or rarely 1 or 2 ovules; style incurved, short, filiform, usually somewhat curved; stigma terminal, capitate or penicillate-pilose; pods oblong, linear or rarely globular, terete or rarely flattened, straight or incurved, 2-valved, divided transversely between the seeds by cellular tissue; seeds globular, or truncate at each end, or flattened.—Herbs, undershrubs, or shrubs with adpressed silky hairs fixed by the middle, and sometimes mixed with loose hairs or tommentum; leaves unequally pinnate, more rarely digitate, 3-foliolate or reduced to 1 leaflet, sometimes simple; leaflets entire; stipules usually small, setaceous, somewhat adnate to the petiole; flowers usually rose-red or purplish red, axillary, rarely sessile, in racemes or spikes, these sometimes united into panicles.

KEY TO THE SPECIES.

Pod reflexed, sickle-shaped, 6 to 8-seeded.	1. *I. suffruticosa.*
Pod straight, shorter than in *I. suffruticosa*, 3 or 4-seeded.	2. *I. guatimalensis.*

1. **Indigofera suffruticosa** Mill.

(Urban, 282.)

A copiously branched shrub 1 to 1.5 meters high; branches straight, woody, deeply sulcate, thinly silvery; stipules small, setaceous; petiole under 2.5 cm. long, firm, erecto-patent; leaves 5 to 10 cm. long, leaflets 6 to 8-jugate, oblong or obovate, 2 to 2.5

cm. long by about half as broad, the lateral ones opposite, short-stalked, both sides subglaucous and thinly silvery, the upper nearly or quite glabrous when mature, turning blackish when dried; racemes moderately dense, 2.5 to 5 cm. long when in flower, nearly sessile; pedicel equaling the obliquely campanulate, thinly silvery calyx, which is not more than 1 mm. deep, the lower teeth lanceolate, reaching half way down, the upper shorter; corolla fugacious, yellow, 3 to 4.5 mm. long.—Pod reflexed, sickle-shaped, 1 to 2 cm. long, 3 mm. thick, subtetragonous with thickened sutures, glabrous when mature, 6 to 8 seeded.

Near Bayamon in cultivated localities; Sierra de Naguabo, near Rio Blanco; near Yabucoa in the coast districts; near Patillas on the sea at Guardaraya; near Coamo, in meadows between Serillos and Salinas; near Adjuntas on declivities at Saltillo; near Guayanilla on calcareous mountains near Peñon; near Guanica, in fields at Punta de los Pescadores and in coast districts near La Ballena; near Cabo Rojo in pastures; near Mayaguez and Añasco.—Bahama, Cuba, Jamaica, Cayman (Hitchcock), Haiti, St. Thomas, St. Croix, St. John, St. Bartholomew (Stockholm Herbarium), Guadeloupe, Martinique, St. Vincent, Mustique, Bequia (Kew Bull. no. 81, p. 245), Barbados, Grenada, Tobago, Trinidad (Grisebach), Margarita. It is said to be a native of tropical America.

Indigofera suffruticosa is much cultivated in the tropics and subtropics and from it is prepared the well-known coloring matter, indigo. It is obtained in the following manner. The plants are mowed just before the flowering time and soaked in water until the liquid becomes a deep yellowish-green color. The fluid is then drained into large vessels or into a cistern, where it is brought, as much as possible, in contact with the air, by means of wheels and shovels, in order that it may take up oxygen. The indigo substance becomes blue and insoluble in water, and sinks to the bottom in the form of a blue powder. This is strained out by woolen cloths and dried. Indigo finds extensive use as a dyestuff, coloring cotton, wool, and silk dark blue. Mixed with oil, it forms a paint of great body, but one that is easily decomposed by pure air.

Local name, *añil*, indigo.

2. **Indigofera guatimalensis** Moç. & Sessé.

(Urban, 282.)

Shrub, 1.5 meters high; branches woody, deeply sulcate, thinly silvery; stipules small, setaceous; petiole about 1 cm. long, firm erecto-patent; leaves 4.5 to 6 cm. long; leaflets 4 to 6 pairs, oblong or obovate, 1 to 2 cm. long, 5 mm. broad, the lateral ones opposite, short-stalked, the upper one with a petiolule 5 mm. long, all clothed on both sides with rather long gray hairs; racemes 1 to 1.5 cm. long, nearly sessile; pedicel about 1 mm. long; calyx pilose, 1 mm. deep; corolla 3 mm. long; pod erect, straight, subtetragonous, pilose, 1 cm. long, 2 mm. wide, with thickened sutures, 3 or 4-seeded.

Near Cabo Rojo in pastures; near Mayaguez, on hills toward Boquillas; near Rincon on declivities at Çalvache.—Cuba (cultivated, Prain and Baker), St. Thomas, Martinique (introduced), Guatemala (Prain and Baker), Venezuela, Ecuador (Prain and Baker), Peru.

This plant differs from *I. suffruticosa* in having thick pods which are smaller and fewer-seeded.

30. DALEA L.

Dalea Juss. Gen. 355. 1789, not P. Br. 1756.
Parosela Cav. Desc. 185. 1802.

Calyx 5-cleft or 5-toothed, often glandular; the segments subequal; petals unguiculate, the claws of the wings and keel united with the stamen-tube to the middle, deciduous by an articulation; standard free, inserted at the bottom of the calyx, the limb cordate; stamens 10 (rarely 9) monadelphous, the tube cleft; ovary sessile or shortly stipitate with 2, rarely 3 to 6 seeds; legume membranous, inclosed in the calyx, indehiscent, usually with only 1 seed.—Herbaceous or somewhat shrubby plants, dotted with glands; leaves unequally pinnate (rarely trifoliolate); leaflets small, usually numerous, rarely 3, very rarely only 1, entire; stipules minute, setaceous; flowers white, blue, purple, rarely yellow; spikes pedunculate, terminal or opposite the leaves, dense, often capitate, rarely loosely-flowered.

1. **Dalea domingensis** DC.

(Urban, 283.)

Herbaceous or somewhat shrubby, 0.5 to 2 meters high; stem branched above, leaves 4 to 5 cm. long; leaflets 3 to 5 pairs, oblong or obovate-oblong, 10 to 13 mm. long, 5 to 6 mm. wide, entire, emarginate, the base cuneate, gray-silky on both sides, with pellucid glandular dots; petiolule about 1 mm. long; spikes terminal or opposite the leaves, about 2 cm. long; calyx with long, beautifully plumose setaceous teeth, glandular; corolla 11 mm. long; flowers purple, rose-colored and white in the same spike; standard small, cordate, with several small glands near the middle; pod membranaceous.

Between Coamo and Salinas, in meadows; near Yauco, in meadows by the river near the town; near Guanica, in thickets on the seashore near Cano Gordo.—Cuba, Haiti, St. John. From Texas and New Mexico to Venezuela and Colombia.

31. **TEPHROSIA** Pers.

Cracca L. Sp. Pl. **2**: 752. 1753.
Tephrosia Pers. Syn. **2**: 328. 1807.

Calyx-teeth or lobes subequal, or the lower larger than the rest, the 2 upper ones more united; petals unguiculate; standard suborbicular, often tomentose or sericeous on the outside; wings obliquely obovate or oblong, adhering a little to the keel; keel incurved, obtuse or subacute; upper stamen free to the base or middle; anthers uniform; ovary sessile, with many or rarely 1 or 2 ovules; style incurved or inflexed, more or less flattened with a terminal stigma, often slightly penicillate; pod linear, or rarely ovate, flattened, 2-valved, continuous or slightly septate within; seeds often with a small strophiole.—Herbs, undershrubs, more rarely shrubs; leaves imparipinnate; leaflets numerous, rarely only 1 to 3, the veins in most species numerous, parallel and oblique to the midrib; stipules setaceous or wider and then striate; flowers red, purple, or white, in pairs or clusters, in terminal, leaf-opposed, or rarely axillary racemes, the lower clusters occasionally or sometimes all in the axils of the leaves.

KEY TO THE SPECIES.

Perennial with a thick rhizome; stipules subulate or lanceolate; leaves 5 to 7-jugate; leaflets obtuse, with a mucro; flowers 1 to 1.5 cm. long, pale purple.	1. *T. cinerea.*
Stipules setaceous; leaves 2 or 3-jugate; leaflets obtuse, emarginate; flowers 7 mm. long, blood-red.	2. *T. cathartica.*

1. **Tephrosia cinerea** (L.) Pers.[a]

(Urban, 283.)

Perennial with a thick rhizome, 33 to 45 cm. high; leaves 5 to 7-jugate; leaflets cuneate-oblong or linear, obtuse, mucronate, 2 to 2.5 cm. long, 8 to 9 mm. wide; stipules lanceolate or subulate; raceme 7.5 to 15 cm. long; flowers pale purple or rose-colored, 10 to 15 cm. long; calyx 5 mm. deep; standard 11 mm. long; pod 3.5 to 4.5 cm. long, 4 mm. wide, 5 to 9-seeded.

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[a] Cook and Collins, p. 128, as *Cracca cinerea*.

Near Bayamon, in coast districts at Cataño; near Cabeza de San Juan, in coast districts; near Patillas, in thickets on the seashore at Guardaraya; near Coamo, around Los Baños along roads, in the valley of El Tendal River in rocky ground, on El Fuerte River, and near the Salinas Lagoons; near Peñuelas; near Yauco; near Guanica, in coast districts between Barina and La Boca and at Salinas; near Salinas de Cabo Rojo at Los Morillos; near Mayaguez, in coast districts at Algarrobo; near Rincon at Cabo San Francisco.—Bahama, Cuba, Jamaica, Cayman (Millspaugh), Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Martin (Stockholm Herbarium), St. Bartholomew (do.), St. Kitts (Grisebach), Antigua (do.), Guadeloupe, Désirade (Grisebach), Marie Galante (Duss), Dominica (Grisebach), St. Vincent, Tobago, Margarita, Curaçao. Tropical continental America.

On account of the strong resemblance of the Tephrosia species, it is often difficult to distinguish them. *T. cinerea* differs from *T. purpurea* in having calyx teeth that are almost twice as long as the tube. The racemes are also shorter in *T. cinerea*.

In tropical America the young branches and leaves of this plant are crushed and mixed with quicklime, and the mixture used for narcotizing fish.

Local name, *añil cenizo*.

2. **Tephrosia cathartica** (Sessé & Moç.) Urb.[a]

(Urban, 283.)

The stem woody, branches firm, angular, thinly gray-silky; stipules setaceous, minute, 2 mm. long; leaves 5 to 7 cm. long, imparipinnate, 2 to 3-jugate; leaflets oblong or obovate-oblong, 1.4 to 3.5 cm. long, 6 to 12 mm. wide, gray-silky on both sides, entire, blunt, emarginate, papyraceous; petiolule of lateral leaflets 1 mm. long, that of terminal one 6 mm.; racemes both terminal and leaf-opposed, lax, 5 to 15 cm. long; flowers solitary or in pairs, bracts minute; pedicel about 2 mm. long; calyx 4 mm. long, pilose outside, the lanceolate, acuminate teeth exceeding the tube; flowers blood-red, 7 mm. long; pod linear, downy, 3.5 cm. long, 5 mm. wide, stipitate, 5 or 6-seeded.

Near Mayaguez, in coast districts at Algarrobo; near Rincon at Cabo San Francisco; near Vega Baja, in sandy soil.—Bahama, Cayman, Haiti, St. Kitts, Trinidad, Ruatán Island (Bay of Honduras), Cartagena.

Poiret says that *Cytisus sessiliflorus* Poir. has been collected in Porto Rico, but the original specimen was probably collected by Ledru or Riedlé in Trinidad, not in Porto Rico.

32. BARBIERIA DC.

Barbieria DC. Prod. **2**: 239. 1825.
Barbiera SPRENG. Gen. **2**: 587. 1831.

Calyx long-tubuliform, with acute subequal segments; petals with long claws; standard oblong, narrowed below into a claw; wings oblong, adhering to the keel; petals of the keel longer than the wings, obtuse; upper stamen free, the others connate; anthers uniform; ovary sessile, multiovulate; style long, slender, bearded on the inner side; pod linear, straight, compressed, 2-valved, indented between the seeds on the outside, septate; seed transverse, oblong.—Shrubs; leaves imparipinnate; leaflets entire, numerous; stipels long, subulate; stipules acuminate-subulate; flowers 2 or 3 together, in terminal or axillary racemes, rather large, red; bracts and bracteoles lanceolate-subulate.

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[a] Cook and Collins, p. 128, as *Cracca leptostachys*.

1. **Barbieria pinnata** (Pers.) Baill.[a]

(Urban, 284.)

Herb or undershrub, 0.5 to 4 meters high; leaflets 15 to 21, oblong or ovate-oblong. stipellate, 2 to 4 cm. long, 1 to 1.25 cm. wide, mucronate, membranous, with scattered hairs above, appressed-sericeous below; racemes 8 to 10 cm. long; flowers vermilion; calyx tube 19 mm. long, calyx teeth 10 mm. long, colored; corolla 5 to 6 cm. long; standard twice as long as the calyx; pod 5 to 6.5 cm. long, 6 mm. broad, pilose; seeds black.

Near Bayamon, in shady places; near Utuado, on slopes at Pellejas; near Maricao, on slopes; near Lares, on shady slopes at Palma Llanos; near Mayaguez, on Mount Mesa and at Mayaguez-Arriba; near Aguada, in the forests at Piedra Blanca.—Cuba, Haiti, tropical South America.

Noticeable are the long calyx and showy red flowers of this species. It has also long, pinnate leaves, with many leaflets, which are pubescent on the lower surface.

Local name, *enredadera*.

33. GLIRICIDIA H. B. K.

Gliricidia H. B. K. Nov. Gen. & Sp. 6: 392, 393. 1823.

Calyx teeth broad, short, the two upper ones subconnate; standard large, reflexed, sometimes with a pair of inflexed auricles at the base; wings arcuate-oblong, transversely plicate, free; keel obtuse, inflexed; upper stamen free, the rest connate, forming a sheath; anthers uniform; ovary stipitate, multiovulate; style awl-shaped, inflexed, glabrous, or beneath the stigma somewhat hairy; stigma small, terminal; pod stalked, broadly linear, unwinged, 2-valved, not septate within, the valves coriaceous.—Trees or shrubs; leaves imparipinnate; leaflets entire, not stipellate; stipules small; flowers rose-colored, in axillary racemes, or in fascicles on the old wood; bracts and bracteoles small or wanting.

1. **Gliricidia sepium** (Jacq.) Steud.

(Urban, 284.)

Tree 8 meters high or higher; leaflets 9 to 17, ovate-oblong or ovate-lanceolate, broadly acuminate, obtuse at the apex, 3.5 to 6.5 cm. long, 1.5 to 2 cm. wide, subcoriaceous, subglabrous; flowers in many-flowered racemes, rose-colored; calyx with 5 very small teeth, glabrous or slightly pilose outside, 4 to 5 mm. deep; standard 20 to 25 mm. long, rose-colored, yellow above the base, keel inflexed; ovary glabrous; pod 10 to 20 cm. long, 1.1 to 2 cm. broad, subligneous.

Near Añasco. Not indigenous in Porto Rico, but introduced from Cuba (Gundlach); Jamaica (Hansen); Haiti (Picarda); Domingo (Millspaugh).—Mexico, Nicaragua, Guatemala, Yucatan, Panama.

In the specimens from Mexico and Yucatan the flowers are irregularly spotted and striped with brownish-purple, and Urban makes of them a new form (forma *maculata* Urb.; *Robinia maculata* H. B. K.). According to Preuss, this tree is much used in Nicaragua for shading coffee and cacao. It is also grown for hedges.

Local names: Nicaragua, *madre de cacao, madera negra* (Preuss); Cuba, *bien vestida* (Gruner); Mexico, *cacaguananchi* (Lamb); Carthagena, *mata raton* or *maton* (Jacquin).

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[a] Cook and Collins, p. 89, as *Barbieria polyphylla.*

34. CORYNELLA DC.

Corynella DC. Ann. Sc. Nat. **4:** 33. 1825.
Corynitis SPRENG. Syst. **4:** Cur. Post. 263. 1827.
Toxotropis TURCZ. Bull. Soc. Nat. Mosc. **19**²: 506. 1846.

Calyx teeth very short or awl-shaped and elongated, the two upper ones connate; standard suborbicular, clawed, reflexed; wings oblong-oblique; keel slightly incurved, longer than the wings and standard; upper stamen free; anthers uniform, with glandular, often colored connective; ovary stipitate, multiovulate; style upwards incrassate; stigma small, slightly capitate; pod oblong, lanceolate, compressed, 2-valved.—Shrubs; leaves paripinnate or imparipinnate; leaflets stipellate; stipules stiff, sometimes spinous; flowers purple, solitary or fascicled at the older nodes of the branches; bracts small; bracteoles wanting.

1. **Corynella paucifolia** DC.

(Urban, 284.)

Shrub 0.5 to 2 meters high; leaflets 3 to 5-jugate, oblong or obovate-oblong, 1 to 2 cm. long, 0.5 to 1 cm. broad, coriaceous, rounded at the apex, often mucronate, cuneate at the base, glabrous; flowers solitary or fascicled along the rachis, blue (Eggers), or blue becoming white, keel violet (Sintenis).

Near Yauco on the sides of Mount Duey; near San German, on a declivity at Lajas Arriba.—Haiti.

The pretty blue flowers of this shrub appear before the leaves.

Local name, *retama*.

35. SABINEA DC.

Sabinea DC. Ann. Sc. Nat. **4:** 92. 1825.

Calyx membranous, broadly campanulate, truncate, almost entire or shortly dentate; standard wide, suborbicular, erect or reflexed; wings oblong-falcate; keel inflexed, obtuse, as long as or somewhat longer than the wings; upper stamen free, the rest equally long, or 5 longer and farther connate; anthers uniform; ovary stipitate, multiovulate; style filiform, much inflexed, glabrous; stigma small, terminal; pod linear, compressed, continuous within, 2-valved, the valves at length spirally curved; seeds rather flat, ovoid or reniform.—Trees or shrubs; leaves paripinnate; common petiole terminating in a point; leaflets caducous; stipules usually setaceous, caducous; flowers purple, solitary or fascicled, on the older nodes of the branches; bracts small, bracteoles wanting.

KEY TO THE SPECIES.

Keel oblong; stamens subequal; style suberect.	1. *S. punicea.*
Keel obliquely obovate; 5 posterior stamens one-half as long as the 5 anterior (all fertile); style and the upper part of the ovary falcate-incurved.	2. *S. florida.*

1. **Sabinea punicea** Urb.

(Urban, 285.)

Probably shrubby; stipules subulate, 3 to 5 mm. long; leaflets 10 to 20, obovate or sometimes oval, rounded or subrotundate subapiculate at the apex, 9 to 15 (sometimes even 26) mm. long, 5 to 9 (sometimes even 16) mm. wide, glabrous beneath or thinly pilose on the middle nerve, lateral nerves on each side 4 or 5, densely reticulate; flowers in the axils of the leaves, many, on a shortened branch, pedicels 0.7 to 1.5 cm. long; calyx 5 mm. long, glabrous, minutely dentate; standard subtriangular-orbicular, very obtuse at the apex, 17 to 18 mm. long, 13 or 14 mm. wide; wings oblong, erect, rounded at the apex, 17 mm. long, 4 mm. wide; keel petals free above, connate below, 20 mm. long; upper stamen free, the rest connate to the middle, subequal; ovary stipitate; legume linear, 5 to 6 mm. wide.

Flowers and leaves appear at the same time.

Near Mayaguez, on Mount Mesa (230 meters altitude); near Maricao, on the slopes of Mount Alegrillo. Indigenous.

Local name, *caracolillo* (Sintenis).

2. **Sabinea florida** (Vahl) DC.

(Urban, 285.)

Shrub 3 to 5 meters high; leaflets 8 to 15-jugate, oblong or elliptical-oblong, 8 to 15 mm. long, 4 to 8 mm. wide, sericeous beneath, often mucronate; calyx 3 mm. long, subentire, turbinate; wings obovate, 1.3 cm. long; keel broad, semiorbicular, 17 to 18 mm. long, 8 to 9 mm. wide; flowers pale lilac or pale violet, axillary, fascicled, blooming before the leaves appear.

Near Bayamon; near Fajardo on Mount Emajagua toward Ceiba; near Yauco on the Duey River not far from Mount Rodadero; near Sabana Grande at the cataract of Estero River; near Cabo Rojo, in thickets on the seashore around Puerto Real; near Quebradillas, and near Manati, in thickets at Rio Arriba Saliente.—Crabb Island (West), St. Thomas, St. John, Dominica (Grisebach).

Local name, *retama.*

36. CRACCA Benth.

Cracca BENTH.; Oersted, Kjoeb. Vidensk. Meddel. 8. 1853, not L. 1753.
Benthamantha ALEF. Bonplandia **10**: 264. 1862.
Brittonamra O. KUNTZE, Rev. Gen. **1**: 164. 1891.

Calyx with subequal subulate-acuminate laciniae; petals subequal; standard orbicular or reniform with reflexed sides; wings oblong-obovate; keel wide, acute or slightly beaked, inflexed; ovary sessile, with numerous seeds; style slightly stiff, inflexed, bearded; stigma capitate; pod linear, compressed, 2-valved, septate, outer surface with impressed transverse lines; seeds almost square.—Perennials with imparipinnate leaves; leaflets stipellate; flowers yellowish or whitish in axillary racemes.

1. **Cracca caribaea** (Jacq.) Benth.[a]

(Urban, 285.)

Shrub 0.5 to 2 meters high, sericeous-pubescent (rarely glabrescent); leaflets 7 to 9-jugate, lanceolate-oblong, 1.6 to 2 cm. long, mucronate; racemes peduncled, few-flowered; flowers 1 to 1.2 cm. long, white, standard rose-white or sometimes rose colored; calyx lobes twice as long as the tube, the lowest longer and exceeding half the keel.

Near Cabeza de San Juan, in shady ravines toward the sea; near Fajardo in coast districts; near Coamo, in meadows between Serillos and Salinas, in the valley of El Fuerte River in rocky places, and in woods near Mount San Ildefonso; near Peñuelas along roads; near Guanica, in thickets on the lagoons and in forests at Mount Ensenada.—Haiti, St. Thomas, St. Croix, St. Martin (Stockholm Herbarium), St. Bartholomew (Euphrasén), Antigua (Grisebach), Guadeloupe, Désirade (Grisebach), Dominica (do.), Martinique, St. Lucia (Grisebach), St. Vincent, Bequia. Central America, Venezuela, Ecuador.

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[a] Cook and Collins, p. 128, as *Cracca aniloides*.

37. SESBANIA Scop.

Sesbania Scop. Introd. 308. 1777.
Agati Adans. Fam. 2: 326. 1763.
Darwinia Raf. Fl. Ludov. 106. 1817.

Calyx broadly campanulate, truncate or with nearly equal teeth or lobes; standard ovate or orbicular, spreading or reflexed; wings oblong; keel incurved, obtuse, or acuminate, with a long claw; upper stamen free, geniculate near the base, the others united in a sheath, angled near the base; anthers uniform or the 5 alternate somewhat longer; ovary usually stipitate with numerous seeds; style with a small terminal capitate stigma; pod long-linear, rarely oblong, compressed, terete or tetragonal, or 4-winged, 2-valved or indehiscent, septate; seeds oblong or quadrate.—Herbs or shrubs, rarely arborescent; leaves abruptly pinnate; leaflets very numerous, entire; stipules caducous; flowers often large, sometimes very large, usually yellow, red, variegated, or white, very rarely a dark purple, in short loose axillary racemes; pedicels slender; bracts and bracteoles setaceous.

KEY TO THE SPECIES.

Flowers in short few-flowered racemes.
  Flowers large, white or carmine-red; petals 8 to 9 cm. long; calyx 2 cm. deep; shrub or tree. 1. *S. grandiflora.*
  Flowers small, a dull yellow, 1.2 cm. long; calyx 3 mm. long; herb. 2. *S. sericea.*
Flowers in lax, 4 to 12-flowered racemes.
  Flowers orange-colored or yellow; petals 2.25 cm. long; calyx 6 mm. deep; leaves slightly irritable. 3. *S. occidentalis.*
  Flowers bright yellow; petals 1.25 cm. long; calyx 4 mm. deep; leaves not irritable. 4. *S. aegyptiaca.*

1. **Sesbania grandiflora** (L.) Pers.[a]

(Urban, 286.)

A tall shrub or small tree of very few years' duration; leaflets 10 to 30-jugate; flowers white or carmine red; legume linear, 30 or more cm. long, nearly 6.5 mm. wide, compressed; seeds separated by spurious dissepiments.

Cultivated and seemingly spontaneous near Bayamon; near Cabo Rojo; at Mayaguez, in a garden.—Cuba (Richard), Jamaica (Grisebach), Haiti, St. Thomas (Eggers), St. Croix, St. John (Eggers), Gaudeloupe, Martinique, St. Vincent. Indigenous perhaps in the East Indies and north Australia. Cultivated in the Tropics everywhere.

S. grandiflora is most noticeable on account of its large and showy red flowers, which make it one of the most beautiful of the Papilionatae. In India the root, bark, flowers, and the juice of the leaves are used medicinally, while the natives eat the tender leaves, pods, and flowers as a vegetable and in curries. Cattle also eat the leaves and tender shoots. The wood is white, soft, and not durable; is, however, used in Bengal for posts of native houses and for firewood, and as a support for the pepper vine. This species yields a gum resembling kino, of a garnet red color when fresh, but becoming almost black by exposure to the air.

Local names, *gallito*, *báculo*, *cresta de gallo.*

2. **Sesbania sericea** (Willd.) DC.

(Urban, 286.)

Plant 1 to 3 meters high; stem suffrutescent, unarmed, cylindrical, pubescent; leaflets 12 to 20-jugate, oblong-linear, 1.6 to 2.4 cm. long, 4 to 6 mm. broad, blunt or retuse-mucronulate, irritable; racemes short, few-flowered, 4 times or more exceeded by the leaves; flowers 1.2 cm. long, of a dull yellow; calyx one-third as long as the corolla; teeth subulate; standard dotted with purple; legume 20 to 25 cm. long, compressed, at length biconvex, not torulose, shortly beaked, slightly depressed, tumid on both margins.

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[a] Cook and Collins, p. 68, as *Agati grandiflora.*

Near Guanica in the water of the lagoon; near Mayaguez, along roads in coast districts near Algarrobo and around the fortress; near Añasco in moist meadows at Hatillo.—Bahama, Jamaica, Haiti, St. Thomas, Antigua (Grisebach), Guadeloupe, Martinique.

3. **Sesbania occidentalis** (Willd.) Pers.

(Urban, 286.)

Undershrub, stem angular, suffrutescent or shrubby, 2 to 3 meters high; leaflets 12 to 20-jugate, slightly irritable; flowers yellow or orange-colored, with red lines, the standard dotted with purple; legume 20 to 25 cm. long, 5 to 6 mm. wide, compressed, at length biconvex; seeds separated by spurious dissepiments.

Near Ponce in ditches and in moist localities; near Guanica, in the water of the bay opposite La Plata; near Cabo Rojo around the hacienda Carmelita; near Mayaguez, on the sides of ditches in Cuesta de las Piedras.—Cuba, Haiti, Trinidad (Grisebach). Indigenous in the West Indies.

Although the difference in the size of the leaves and the form of the leaflets between *Sesbania occidentalis* and *S. grandiflora* is very slight, the difference in the size of the flowers is very noticeable, those of *S. grandiflora* being at least 5 times as large as those of *S. occidentalis*.

Local name, *sesbania*.

4. **Sesbania aegyptiaca** Pers.

(Urban, 286.)

An erect, copiously branched, pale green glabrous shrub, 1.5 to 2.5 meters, even 3 meters high; leaves nearly sessile, the unarmed rachis on the upper ones 5 to 10 cm. long; leaflets 10 to 20-jugate, glabrous, glaucous green, reaching 2.5 cm. in length, 4 mm. broad, blunt with a faint mucro; peduncles 2.5 to 5 cm. long; racemes lax, 6 to 12-flowered; pedicels spreading, 0.4 to 0.8 cm. long; calyx 0.4 cm. long, glabrous, the teeth very short, deltoid-cuspidate; corolla bright yellow, 1.25 cm. long, the round emarginate standard 1.25 cm. broad, more or less dotted with purple; pod 15 to 20 cm. long, 3 to 4 mm. thick, distinctly torulose, 20 to 30-seeded, the valves rounded on the back.

Near Coamo between Serillos and Salinas.—Cuba, Jamaica (Grisebach). Southeastern North America, warmer regions of Africa, tropical Asia, and North Australia.

The wood of this plant is soft and fibrous but rather close-grained, the weight 75 pounds to the cubic foot. In the Deccan, *Sesbania aegyptiaca*, is grown to furnish poles as a substitute for bamboo, and it is often utilized while growing to shade and support the pepper vines and various cucurbitaceous plants. In Assam the soft, pithy stems are platted into mats, portions of them being dyed black before being matted so as to work out a bold pattern. It is, in Bengal, in common use as a hedge plant, for which purpose its very quick growth renders it suitable. The bark is made into rope, according to Brandis. Seeds, root, juice of the bark, leaves, and flowers are used medicinally. The leaves and young branches are cut for fodder.

38. **PICTETIA** DC.

Pictetia DC. Bibl. Univ. Geneve **29**: 40. 1825.

Calyx with unequal slender lobes, the two upper ones short and obtuse, the three lower longer and acuminate; petals shortly unguiculate; standard suborbicular;

wings obliquely oblong, somewhat longer than the obtuse keel; upper stamen free; ovary stipitate, multiovulate; style filiform; stigma terminal, capitate; pod stalked, oblong or widely linear, compressed, without articulations or separating into 1 to 6 oblong, coriaceous, striate ones; seeds oblong or ovoid, somewhat flat.—Shrubs, glabrous; leaves imparipinnate; leaflets 3 to many, spinescent or pungent; stipules often pungent; flowers yellow, in the axils of the leaves, solitary or in slender few-flowered racemes; bracts and bracteoles caducous.

Professor Urban has written a monograph of the West Indian species of this genus, which is nearly related to Ormocarpum. He distinguishes two sections. The first, Racemosae Urb., is characterized by the numerous (15 to 25) leaflets, truncate or usually emarginate at the apex, and by the elongated inflorescence. To this section belong two species: *P. obcordata* DC. (San Domingo) and *P. aculeata* (Vahl) Urb. (widely distributed in the West Indies, first described by Vahl as *Robinia aculeata*). The second, Fasciculatae Urb., has the leaflets fewer (3 to 7), linear or obovate, acuminate or rounded at the apex; the inflorescence short with fasciculate flowers. This section comprises also two species: *P. spinifolia* Urb. (occurring in Haiti and San Domingo) and *P. marginata* Sauv. (found as yet only in Cuba). P. De Candolle, the author of this genus, which is very characteristic of the West Indian Leguminosae, enumerates six species, of which Urban thus admits only four.

1. **Pictetia aculeata** (Vahl) Urb.[a]

(Urban, 287.)

Shrub 3 to 4 meters high or tree 10 meters high; petioles 0.7 to 1.5 cm. long; leaflets 15 to 25, obovate-orbicular, rotundate, or obcordate, truncate or sometimes broadly emarginate at the top, rounded or subtruncate at the base, 0.7 to 2 cm. long and wide; pedicels 25 down to 12 mm. long; flowers yellow; calyx-tube 3 to 4 mm. long; standard 17 to 22 mm. long; pod broadly linear, more or less incurved, 2.5 to 5 cm. long, 5 to 7 mm. wide, with 2 to 6 articulations.

Near Fajardo, in copses on the seashore toward the light-house; between Arroyo and Guayama, along roads; near Coamo, in woods at San Ildefonso; near Peñuelas in woods; at Salinas de Cabo Rojo in forests on the seashore.—Haiti (Jacquin), Vieques (De Candolle), Water Island, St. Thomas, St. John (Eggers), St. Croix (Jacquin), Trinidad (probably cultivated).

Local name, *tachuelo*. St. Thomas, *fustic*.

39. AESCHYNOMENE L.

Aeschynomene L. Sp. Pl. **2**: 713. 1753.
Aedemone Kotschy, Oestr. Bot. Zeitsch, **8**: 116. 1858.
Herminiera Guill. & Perr. Fl. Seneg. Tent. 201. *pl. 51.* 1832.

Calyx lobes 5, nearly equal or united into two lips, either entire or the upper one 2-lobed, the lower 3-lobed; petals with short claws; standard orbicular; wings obliquely obovate-oblong, about equal to the standard; keel sometimes obovate, obtuse, nearly straight, sometimes narrow, acute or beaked, and much curved, the petals free or connected by means of little hairs, or connate; stamens usually all united in a sheath more or less split on both the upper and the lower edge, dividing the stamens into 2 bundles of 5 each; anthers reniform; ovary stipitate, with 2 to many ovules; style incurved, the stigma terminal, sometimes subcapitate; pod stipitate, more or less linear, straight, annular, or falcate, smooth or muricate on the flat or slightly convex faces, separating into 2 to many short, flat, usually indehiscent, reticulated articulations.—Procumbent or erect herbs, undershrubs, or shrubs with equally or unequally pinnate leaves; stipules membranous or foliaceous, lanceolate or setaceous; flowers seldom large, usually small, sometimes very small, gold-colored or pale yellow, often streaked with purple, fugacious, in axillary or rarely terminal racemes; bracts resembling the stipules in form. Bracteoles usually addressed against the calyx, often caducous.

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[a] For illustrations see Cook and Collins, *pls. 42, 43*, facing p. 218 (as *Pictetia aristata*).

KEY TO THE SPECIES.

Leaves 10 to 30-jugate.
  Leaflets 1-nerved; stipules semisagittate; flowers whitish in lax few-flowered racemes; peduncle 1.5 cm. long; pod long-stipitate, straight, the joints quadrate, rectilinear on the superior, slightly curved on the inferior margin. 1. *A. sensitiva.*
  Leaflets 3-nerved; stipules calcarate; flowers yellow or purple in dense racemes; peduncle very short; pod shortly stipitate, incurved, contracted at the dissepiments, the joints half-round, rectilinear on the superior, rounded on the inferior margin. . 2. *A. americana.*
Leaves 4 or 5-jugate. 3. *A. portoricensis.*

1. **Aeschynomene sensitiva** Sw.

(Urban, 287.)

Shrubby or suffrutescent, 1 to 4 meters high; stipules 6 to 9 mm. long, semisagittate, caducous; leaves 2 to 10 cm. long; leaflets 15 to 20-jugate, linear-oblong, 6.5 to 9 mm. long, 2 to 3 mm. wide, glabrous, glaucous, sensitive; flowers 2 to 4, in very lax racemes; calyx 4 mm. deep, cleft nearly to the base; corolla pale yellow, the standard red-veined outside, not more than 0.6 mm. deep; pod 3.5 to 5 cm. long, 5 mm. wide, 6 to 9-jointed, the lowest articulation on a pedicel 0.6 mm. long, the upper suture nearly straight, lower deeply indented, the face with a few scattered setae, black.

Near Bayamon, in moist meadows at Pueblo Viejo; near Fajardo in ditches; Sierra de Luquillo, in swampy places half-way to the top of Mount Jimenez; near Aibonito, in swamps at Buena Vista; near Utuado, on the Rio Grande River at Salto Arriba; near Guanica, in swamps on the lagoon toward La Plata; near Cabo Rojo in swamps; near Mayaguez, on the sides of ditches and on Mount Mesa at 330 meters altitude; near Añasco in moist fields toward the sea; near Lares, in grassy places at Anones.—Cuba, Haiti, Guadeloupe, Dominica (Swartz, Grisebach), Martinique, St. Lucia (Swartz), St. Vincent, Grenada, Trinidad (Grisebach). Tropical Africa.

A common American plant, extending from the West Indies to Brazil.

A. sensitiva, like the next, seems to be inhabited by ants. The plant can be readily recognized by its semisagittate stipules, and its lax few-flowered racemes.

Local names, *yerba rosario*, *yerba de cienega.*

2. **Aeschynomene americana** L.

(Urban, 287.)

Stem herbaceous or suffrutescent, 1 to 2 meters high; leaves 3 to 5 cm. long; leaflets 10 to 30-jugate, oblong-linear, 7 to 9 mm. long, 2 mm. wide; flowers pale yellow, sometimes nearly white with dark red lines; calyx 4 mm. long; corolla 8 to 9 mm. long, yellow or purple; pods 2 to 4 cm. long, 5 mm. wide, glabrous.

Near Bayamon in meadows; between Aibonito and Coamo along roads; near Coamo at the river in Farajones; near Maricao on Mount Montoso; near Sabana Grande toward La Plata along roads; near Mayaguez, on the bank of the river and at the base of Mount Mesa; near Añasco in ditches around Hatillo.—Cuba, Jamaica, Haiti, St. Thomas, St. Croix, St. Kitts, Guadeloupe, Dominica, Martinique, St. Vincent, Grenada, Tobago, Trinidad (Grisebach). Found in many parts of tropical America, also introduced in the Old World. Frequent as a weed on cultivated land.

The large spurred stipules of *A. americana* are used as a dwelling place by ants. By the form of the stipules it can easily be distinguished from *A. sensitiva.* The half-round joints of the pod, rectilinear on the superior, rounded on the inferior margin, are also striking.

Local name, *yerba rosario.*

3. **Aeschynomene americana villosa** (Poir.) Urb.

(Urban, 288.)

Flowers orange-colored.

Near Aibonito, at Algarrobo; near Cayey at 330 meters altitude; near Guanica, on gravelly banks at Barina; near Maricao in pastures; near Mayaguez around the fortress; near Rincon, in rocky places at Barrio del Pueblo; near Aguada, on plains at Piedra Blanca.—Cuba, Martinique.

4. **Aeschynomene portoricensis** Urb.

(Urban, 288.)

Perennial or undershrub; stipules ovate or lanceolate, 1.5 to 2.5 mm. long; leaflets obovate or oval, rounded at the top, subcordate at the base, 5 to 8 mm. long; inflorescence 10 to 15 mm. long, axillary, simple, 1 or 2-flowered; flowers yellow, 5 mm. long; pedicel 3 to 5 mm. long; calyx 2.5 mm. long; petals subequal; pod 4 to 5 mm. long, stipitate, the articulations 2 to 4; seeds subtriangular-ovate, olive-green, smooth, shiny.

Near Maricao; near Manati, in the sand on the shore of Lake Tortuguero.—Indigenous.

This is the only one of the Porto Rico Aeschynomenes that has 4 or 5-jugate leaflets.

40. **STYLOSANTHES** Sw.

Stylosanthes Sw. Prod. Veg. Ind. Occ. 108. 1788.

Calyx with an elongated filiform tube and scarious lobes, the four upper ones connate, the lowest distinct, elongate; petals and stamens inserted at the throat of the tube; standard orbicular or suborbicular, emarginate; wings oblong, free; keel incurved, subrostrate; stamens all connate, in a closed tube, the anthers alternately longer and fixed near the base and shorter and versatile; ovary nearly sessile at the base of the tube, 2 or 3-ovulate; style long, filiform, after flowering broken at the middle or near the base, the portion that remains becoming decurved; stigma minute and terminal; pod subsessile, compressed, crowned with the persistent curved base of the style, the articulations usually two, sometimes solitary, rugose-reticulated.—Pilose, often hirsute-setose, sometimes viscous herbs or undershrubs; leaves pinnate; leaflets 3, lanceolate to linear; stipules adnate to the petiole except the long, free, subulate apices; flowers yellow, axillary or terminal, in dense spikes or heads.

1. **Stylosanthes hamata** (L.) Taub.[a]

(Urban, 288.)

Stems procumbent or diffuse, from a few centimeters to 1 meter high; leaflets oblong or oblong-lanceolate, 7 to 17 mm. long, 2 to 6 mm. wide, pointed, glabrescent; flowers yellow, in bracteate spikes 15 mm. long, single or with an accessory striate pedicel; legume sessile, 2 or 1-jointed, usually 1-seeded, mucronate by the uncinate style base.

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[a] Cook and Collins, p. 245, as *Stylosanthes procumbens.*

Near Bayamon in coast districts at Palo Seco; between Aibonito and Coamo on rocks; near Coamo in sunny copses on Juey brook; near Guanica, in rocky coast districts at Caño Gordo; near Salinas de Cabo Rojo in the sandy soil of the seashore.—Bahama, Cuba, Jamaica, Cayman (Hitchcock), Haiti, St. Thomas, St. John (Eggers), St. Martin (Stockholm Herbarium), St. Bartholomew (do.), St. Kitts, Antigua (Taubert), Guadeloupe, Désirade, St. Vincent, Bequia (Kew Bull. no. 81, p. 245), Barbados, Grenada. North and South America.

Local name, *zarzabacoa enana.*

41. ARACHIS L.

Arachis L. Sp. Pl. **2**: 741. 1753.
Mundubi ADANS. Fam. **2**: 323. 1763.
Arachidna MOENCH, Meth. 121. 1794.

Calyx tube filiform, the lobes membranous, the four upper ones connate, the lowest thin, distinct; petals and stamens inserted into the apex of the tube; standard suborbicular, wings oblong, free; keel incurved, rostrate; stamens all connate in a closed tube, sometimes only 9; anthers alternately longer and shorter, fixed near the base and versatile; ovary subsessile at the base of the tube, 2 or 3-ovulate, the torus after the flower falls becoming an elongated, deflexed, rigid stalk forcing the fruit into the ground, the apex acute, and after the style falls terminated by a stigma-like callus; style long, filiform; stigma minute, terminal; pod ripening beneath the soil, oblong, reticulated, indehiscent, subtorulose, but not articulated, continuous within; seeds 1 to 3, irregularly ovoid.—Low, often prostrate herbs; leaves paripinnate; leaflets usually 2-jugate, rarely one abortive; stipules adnate to the petiole; flowers yellow or whitish, in axillary, solitary, sessile, dense spikes; bracts often auriculate; bracteoles linear.

1. Arachis hypogaea L.

(Urban, 289.)

Stems 30 to 60 cm. long, herbaceous, diffuse, the branches clothed especially above with spreading hairs; stipules 2.5 cm. long, the lower half adnate, the points lanceolate; petioles 2.5 to. 35 cm. long, silky; leaflets in two pairs, without a terminal one, obovate, 3 to 5 cm. long by more than half as broad; flowers yellow, axillary, solitary, on long slender pedicels, only the lower ones fertile; pod 2.5 cm. long, 1.2 cm. thick.

Cultivated and seemingly wild near Bayamon; near Yauco, on Mount Duey in maize fields; near Mayaguez.—Cuba (Sagra), Jamaica (Grisebach), St. Thomas (Eggers), St. Croix (do.), St. John (do.), St. Bartholomew (Euphrasén), Antigua (Grisebach), Guadeloupe, Dominica (Grisebach), Martinique, St. Vincent. Cultivated everywhere in the Tropics. It is probably a native of Brazil, to which country the six other species of the genus belong exclusively.

Arachis hypogaea, the peanut, groundnut, goober, Manila nut, is not only found in all tropical countries, but is sometimes cultivated in southern Europe (in Italy, Spain, and France) and is extensively grown in the United States, from Virginia southward. In the United States the seeds are consumed in very large amounts after roasting, being sold on the streets and eaten between meals, while smaller but considerable quantities are used in confectionery and in the form of "peanut butter." In the Old World millions of bushels are utilized for making an oil which is similar to the finest olive oil and is largely substituted for it. The oil cake is used as food for live stock, and in Spain from it is made, by mixing it with cacao, sugar, and spices, a kind of chocolate, which is the daily food of the poorer people.

According to Cook and Collins the Porto Rican peanuts are very small in size and not many are grown.

Local name, *mani.*

42. **ZORNIA** Gmel.

Zornia GMEL. Syst. 2^2: 1076, 1096. 1791.
Zonaria STEUD. Nom. ed. 2. **1**: 101. 1840.

Calyx tubuliform-campanulate, membranous, the two upper teeth rather long, subconnate, the two lateral ones much shorter, the lowest lanceolate-oblong, almost as long as the upper ones; petals unguiculate; standard suborbicular; wings obliquely obovate or oblong; keel incurved, subrostrate; stamens all connate in a tube; anthers alternately longer and shorter, attached near the base and versatile; ovary sessile, multiovulate; style filiform; stigma small, terminal; pod compressed, the upper suture nearly straight, the lower deeply sinuate, the articulations indehiscent, smooth, or echinate; seeds orbicular or subreniform.—Herbs or suffrutescent; leaves equally pinnate; leaflets 2 or 4, often punctate; stipules usually foliaceous; flowers solitary, sessile or shortly stipitate, in lax terminal or axillary spikes hidden each by a pair of persistent bracts; bracteoles wanting.

1. **Zornia diphylla** (L.) Pers.

(Urban, 289.)

Herb; stem 30 cm. or more long, slender, herbaceous, glabrous, diffusely branched from the base; stipules lanceolate; petioles 1 to 2 cm. long, the leaflets in a single pair at the apex, lanceolate 2.5 to 3.5 cm. long, 6 to 9 mm. wide, the edge slightly ciliate, the surface glabrous; flowers in lax axillary stalked racemes 5 to 7.5 cm. long, 6 to 8 in number, hidden each by a pair of persistent bracts, which are ovate, rigid, 6 to 9 mm. long, slightly bristly-ciliate; calyx 3 to 4.5 mm. long, scarious; corolla 6 to 9 mm. long, purplish; pod sometimes exceeding the bracts, articulations 2 to 4, the bristles 1 to 2 mm. long.

Near Bayamon in sandy meadows; near Salinas de Cabo Rojo on the edge of the woods; near Mayaguez, on slopes of Mount Mesa; near Añasco; near Aguada, on plains at Rosario; near Manati, in sandy soil at Campo Alegre around Tortuguero Lake.—Cuba, Jamaica, Haiti, St. Thomas, St. Croix (De Candolle), Guadeloupe, Désirade (Grisebach), Dominica (do.), Martinique, St. Lucia, Barbados, Trinidad (Grisebach). This plant is found everywhere in the tropics and subtropics.

Zornia diphylla is stacked by the Foulahs of western Africa for horse provender. It is sometimes used as a remedy against fever.

Local name, *zarzabacoa de dos hojas.*

43. **DESMODIUM** Desv.[a]

Meibomia ADANS. Fam. **2**: 509, 575. 1763.
Desmodium DESV. Journ. Bot. **1**: 122. *pl. 5. fig. 15.* 1813.
Pleurolobus J. St. Hil. Nouv. Bull. Soc. Philom. **3**: 192. 1812.

Calyx with campanulate or turbinate short tube, the upper two teeth more or less united, the other three acute or subulate-acuminate; petals sessile or unguiculate; standard oblong, obovate, or suborbicular, usually narrowed toward the base, seldom obtuse or subcordate above the claw; wings obliquely oblong, adherent to the keel without appendage or by means of a membrane or a tubercle; keel straight, sometimes incurved, obtuse, rarely rostrate; upper stamens free at the base, toward the middle connate with the others; ovary sessile or stipitate; style inflexed; stigma small, terminal, often capitate; pod exserted, sessile, or stipitate, compressed, superior suture straight or like the inferior more or less sinuate, with 1 to many membranous or coriaceous articulations, flat or rarely subturgid, glabrous or more or less hispid, usually indehiscent at maturity and separating from one another, sometimes dehiscing by the inferior suture; seeds 2 to many, ovoid or globose-reniform, compressed.—Herbs or shrubs, sometimes arboreous or scandent; leaves bipinnate; leaflets usually 3, sometimes only 1 (the terminal), rarely 5, often rather large, with stipels; stipules often scarious, striate, or connate; flowers small, rose-colored, purple, bluish, or white, in compound rarely simple racemes, terminal, or axillary; occasionally solitary or a few fascicled in the axils; bracts often membranous, subulate, striate, persistent, or caducous; bracteoles distinct and persistent or very small and caducous, often entirely wanting.

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[a] Cook and Collins, pp. 188, 189, as Meibomia.

KEY TO THE SPECIES.

Flowers in terminal, short, crowded racemes, or 2 to 4 together in the axils of, or opposite to the leaves.
  Flowers in short, crowded racemes, in pairs in the axils of the wide caducous bracts. (Section NICOLSONIA.) — 1. *D. barbatum.*
  Flowers 2 to 4 together on long filiform pedicels in the axils of the leaves or opposite to them, more rarely in few-flowered terminal racemes, when they are solitary in the axils of the bracts. (Section SAGOTIA.) — 2. *D. triflorum.*
Flowers in lax, usually elongated, racemes or panicles.
  Upper suture of the pod straight, the lower deeply indented; pod indehiscent. (Section HETEROLOMA.)
    Bracts rather large and wide, before florescence imbricate. — 3. *D. ascendens.*
    Bracts small, inconspicuous.
      Stipules more or less connate at the base.
        Articulations of the pod 2; stipe longer than the calyx. — 4. *D. axillare.*
        Articulations of the pod numerous; stipe shorter than the calyx. — 5. *D. supinum.*
      Stipules usually free, only the younger ones slightly connate.
        Stipules cordate. — 6. *D. albiflorum.*
        Stipules oblong-lanceolate or lanceolate. — 7. *D. wydlerianum.*
  Both sutures of the pod deeply indented, indehiscent. (Section CHALARIUM.)
    Pod strongly constricted, more or less tortuous.
      Pod with 2 articulations, superior one enlarged, fertile. — 8. *D. molle.*
      Pod with many equal articulations.
        Perennial, erect; stipules oblique-subulate; pod tortuous, at length flattened; articulations obicular, flat. — 9. *D. tortuosum.*
        Annual flaccid, at length subscandent, rooting at the base; pod very tortuous and lasting so; articulations rhomboid-orbicular. — 10. *D. spirale.*
    Pod slightly constricted at the dissepiments, not tortuous; articulations oval-linear. — 11. *D. scorpiurus.*

1. **Desmodium barbatum** (L.) Benth.

(Urban, 290.)

Suffrutescent, erect, or ascending, 30 to 60 cm. high; leaflets 3, elliptical-oblong, obovate, or elliptical-lanceolate, 1 to 1.5 cm. long, 4 to 7 mm. wide, above glabrous or subpilose, beneath appressed-villose; calyx 4.4 mm. deep, at length nodding, very long brown-pilose, the teeth lanceolate-setaceous, the tube very short; corolla light blue or purple, about as long as the calyx; legume 1 to 1.5 cm. long, 2 mm. wide, indehiscent, the upper suture straight, the lower somewhat indented, reflexed, 2 to 4-jointed.

Near Bayamon, in sandy places; near Lares, in ravines at Espino; near Cabo Rojo, on hills toward Joyuda; near Mayaguez, on the slopes of Mount Mesa; near Aguada, in rocky districts at Rosario; near Manati, on plains at Garrochales.—Cuba (Grisebach), Jamaica, Haiti, Martinique, St. Lucia, Tobago, Trinidad. In tropical America, a common plant, in pastures, and on the roadside. Also introduced into the Old World.

The short, many-flowered racemes and the deep, densely plumose calyx make this common plant of the Tropics easily recoginzed.

Local name, *zarzabacoa peluda.*

2. **Desmodium triflorum** (L.) DC.[a]

(Urban, 289.)

Stem widely creeping, copiously and diffusely branched, forming a dense matted cluster, the branches slender, glabrous or thinly clothed with fine spreading silky hairs; stipules lanceolate, acuminate, 4.4 mm. deep; leaflets 3, broadly obovate, terminal one 8.5 to 11 mm. long and nearly as broad, lateral ones smaller, both sides glabrous or subglabrous; flowers blue (Urban); calyx 4 mm. deep, silky, teeth reaching more than halfway down; corolla reddish or white (Oliver), fragrant, about equaling the calyx; pod 1.1 to 1.7 cm. long, 4 mm. wide, the lower suture waved one-third of the way down; articulations 4 to 6, the faces subglabrous.

Near Naguabo in fields around Hacienda Oriente; near Cayey along roads toward Cidra; near Coamo, in the valley of El Tendal River on grassy slopes; near Cabo Rojo on hills toward Joyuda; near Rincon in meadows at Barrio del Pueblo.—Cuba, Jamaica, Cayman, Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Bartholomew (Stockholm Herbarium), St. Kitts, Antigua (Grisebach), Guadeloupe, Martinique, St. Vincent, Barbados, Grenada, Trinidad. Mexico to Brazil, tropical Africa, East Indies.

Desmodium triflorum is a common weed of the Tropics. The fresh leaves are used medicinally. In India Roxburgh says that this is very common on pasture grounds and helps to form the most beautiful turf; further, that cattle are very fond of it. Müller recommends its cultivation in regions too hot for clover. Another author says that in India it springs up on all soils, supplying there the place of Trifolium and Medicago.

Local name, *zarzabacoa de tres flores.*

3. **Desmodium adscendens** (Sw.) DC.

(Urban, 290.)

An undershrub 1 to 1.3 meters high, with ascending woody branches; leaflets 3, obovate, 1.8 to 2.5 cm. long, sometimes nearly as broad as deep, the apex rounded, subcoriaceous, upper surface glabrous, lower finely adpressed-silky; racemes often 15 cm. long; bracts ovate, cuspidate, equaling the slender pedicels, 8.8 to 13 mm. long, spreading ultimately from the rachis at right angles; calyx 6 mm. deep, teeth linear, reaching down nearly to the base; corolla purple or reddish, rarely white, twice as long as the calyx; pod 1.2 to 2 cm. long, 2.2 mm. broad, joints 3 to 6, the lower suture waved halfway down.

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[a] For illustration see Cook and Collins, *fig. 12*, p. 189 (as *Meibomia triflora*).

Near Bayamon in moist sandy soil at Cataño; Sierra de Luquillo halfway to the top of Mount Jimenez in woods; Sierra de Naguabo, near Minas de Cobre at Rio Blanco; near Los Mameyes; near Juncos on roadsides; near Hato Grande on Mount Gregorio; between Aguas Buenas and Caguas along roads; between Caguas and Cayey along roads; near Cayey at Quebrada Arriba; near Aibonito along roads; near Adjuntas, on the declivities of Mount Andubo and on Mount Cedro; near Maricao; near Mayaguez, on declivities of Mount Mesa.—Cuba (Grisebach), Jamaica, Haiti, St. Kitts (Grisebach), Antigua (do.), Guadeloupe, Dominica, Martinique, St. Vincent, Grenada, Tobago, Trinidad (Grisebach). This is a common American species, but in the Old World is only known in Africa.

Local name, *zarzabacoa galana.*

4. **Desmodium axillare** (Sw.) DC.

The Porto Rican material is included in the following varieties and form:

4a. **Desmodium axillare obtusifoliola** (Kuntze) Urb.

(Urban, 291.)

Herbaceous, rarely suffrutescent, creeping, rooting, 30 to 45 cm. long, clothed with very short soft inconspicuous hairs intermixed with hamate ones; leaflets 3, rhomboid, ovate-rhomboid or orbicular-rhomboid, 3.5 to 5.5 cm. long, 2.5 to 4.5 cm. wide, obtuse or rounded at the apex; flowers rose-colored, dark rose-colored, or reddish-violet, about 5 mm. long, the pedicel 6.5 to 13 mm. long; legume long-stipitate, the suture slightly notched, the dorsal margin sinuate as deep as to the ventral suture; articulations deltoid-semioval, 7 to 8 mm. long, 4 to 5 mm wide.

Near Bayamon in shady places; Sierra de Luquillo in woods halfway to the top of Mount Jimenez; near Los Mameyes in moist localities among herbs; near Cayey, in a thicket of *Coffea arabica* at Pedro Avila; near Adjuntas, in woods on Mount La Vaca.—Cuba, Jamaica, Haiti, St. Kitts, Guadeloupe, Dominica, St. Vincent, Grenada, Costa Rica, Venezuela, Colombia, Chile.

This plant is extremely common in shady places in Porto Rico.

Local name, *zarzabacoa de monte.*

4b. **Desmodium axillare acutifolium** (Kuntze) Urb.

(Urban, 292.)

Stem densely clothed with long, soft hairs intermixed with short, often very inconspicuous, hamate ones; leaflets ovate or ovate-elliptical, acuminate; flowers pale purple; articulations of the pod 6 to 8 mm. long, 4 to 5 mm. wide.

Near Bayamon in the woods at Pueblo Viejo, near Juncos on Mount Santo de Leon.—Cuba, Jamaica, Martinique, St. Vincent, Trinidad, Guiana, and Brazil.

4c. **Desmodium axillare** forma **robustius** Urb.

(Urban, 292.)

The stem thicker than in variety *angustatum,* 3 mm. thick and densely hirsute; terminal leaflet 12 cm. long; flowers rather longer than in variety *angustatum;* wings 5 mm. long; pod articulations 10 mm. long, 6 mm. wide; calyx red-brown; petals pale rose-colored; stamens rose-colored; anthers pale yellow (ex Sintenis).

Sierra de Luquillo, in woods halfway to the top of Mount Jimenez.

4d. **Desmodium axillare sintenisii** Urb.

(Urban, 292.)

Pubescence of the stem very short; leaflets ovate, long-acuminate; flowers white; pod articulations 9 to 10 mm. long, 6.5 to 7 mm. wide.

Sierra de Luquillo, halfway to the top of Mount Jimenez; Sierra de Yabucoa, in the primeval forests of Mount Cerro Gordo and Mount Sombrero.—Haiti.

5. **Desmodium supinum** (Sw.) DC.

(Urban, 290.)

A diffuse undershrub 60 to 90 cm. high, branches finely gray-pubescent upward; stipules connate to the middle, at length subdistinct, lanceolate, scarious; leaflets 3, central one oblong or obovate, 7.5 to 10 cm. long, generally under half as broad, its petiolule short, its stipellae minute; lateral leaflets smaller and more rounded at the base, subcoriaceous, the upper surface glabrous, the lower thinly and finely pubescent; calyx 2.2 mm. deep, the teeth lanceolate, reaching halfway down; corolla red, becoming blue or pale purple, 6.5 to 8.5 mm. deep; pod 2.5 cm. long, 3 mm. wide, with 5 to 8 articulations, which are considerably longer than broad.

Near Bayamon in grassy places; near Fajardo along roads and in the river valley toward the mountains; near Juncos along roads; near Maunabo at Punta Tuna; near Cayey at Quebrada Arriba in thickets; near Cabo Rojo along roads around Puerto Real; near Mayaguez.—Bahama, Cuba, Jamaica, Cayman (Hitchcock), Haiti, St. Thomas, St. Croix, St. John, St. Martin (Stockholm Herbarium), St. Bartholomew (do.), St. Kitts, Antigua, Guadeloupe, Dominica, Martinique, St. Vincent, Bequia (Kew Bull. no. 81, p. 245), Barbados, Grenada, Tobago, Trinidad (Grisebach), Margarita.

A common tropical American species, occurring also in Africa and the Mauritius.

Local name, *zarzabacoa.*

5a. **Desmodium supinum angustifolium** (Griseb.) Urb.

(Urban, 291.)

Plant 1 to 1.5 meters high; flowers conspicuous, pale blood-red or pale purple.

Between Aibonito and Coamo, near Algarrobo, in thickets; near Coamo, in the valley of El Tendal River; near Rincon, on shady mountains at Barrio del Pueblo.—Cuba, Haiti, Antigua (Grisebach).

6. **Desmodium albiflorum** Salzm.

(Urban, 292.)

Stem diffuse, 15 to 30 cm. high; leaves sometimes widely, sometimes narrowly ovate, about 2.5 mm. long, obtuse or rarely somewhat acute, membranous; stipules cordate, acuminate, free or at the back connate; flowers white; calyx about 2.2 mm. deep, petals 6.5 mm. long; pod subsessile, its articulations indefinite in number, usually 5 or 6, these when mature 6.5 mm. long, 4.4 mm. wide.

Near Cayey, in coffee plantations at Pedro Avila; near Coamo, in coffee plantations at Farrajones.—Mexico, Central America, Ecuador, and Brazil (Bentham, Hemsley).

7. **Desmodium wydlerianum** Urb.

(Urban, 292.)

Perennial (?), procumbent below, rooting at the nodes, ascending above, shortly pubescent; leaflets triangular-ovate or rhomboid, acuminate, subtruncate at the base, 3 to 6 cm. long, 3 to 5 cm. wide, above shortly pilose, beneath subglabrous; inflorescence 10 to 15 cm. long; calyx about 2 mm. long; flowers violet; standard suborbicular or orbicular-ovate, 4 mm. long; stamens 9; pod (immature) with 2 or 3 articulations.

Eastern part of the island (Schwanecke, Wydler).—Grenada, Tobago.

8. **Desmodium molle** (Vahl) DC.

(Urban, 292.)

Erect; stem shrubby; branches herbaceous, striate, 1.3 to 2 meters high; leaflets 3, ovate, 4 to 5 cm. long, 1.25 to 2.75 cm. wide, membranaceous, pubescent on both sides; stipules subulate-setaceous; flowers very small, 3.3 mm. long, greenish outside, dark blue within; calyx segments linear, long; pod membranaceous, flat; articulations at first elliptical, reniform with a lateral notch when mature, 6.5 to 8.5 mm. long, 4.4 to 5 mm. wide.

Near Coamo in meadows between Serillos and Salinas; near Juana Diaz, along roads about Escalabrado; near Guanica, on declivities at Punta de la Meseta and in thickets at Montalba.—Jamaica (Grisebach), Haiti, St. Thomas, St. Croix (Vahl), Martinique, Curaçao, Central America, South America.

The legume of *D. molle* is quite unlike that of any other Porto Rican Desmodium. It has a pod with 2 elliptical articulations, of which the upper is enlarged and fertile, and when mature has a lateral notch. This is the only pod with a reniform articulation within this genus in Porto Rico.

9. **Desmodium tortuosum** (Sw.) DC.

(Urban, 293.)

Erect, 0.5 to 1.5 meters high; stem striate, cylindrical, the down uncinate; leaflets 3, ovate or ovate-oblong, the terminal one 2.5 to 10 cm. long, 1 to 4.5 cm. wide, hispidulous or glabrescent; pedicels filiform, longer than the flower; flowers small, purple or pale blue; calyx 2 to 3 mm. deep; corolla 5 to 6 mm. long; pods with 2 to 6 articulations, constricted nearly to the center.

Near Bayamon, in shady localities and along roads toward Toa Baja; near Fajardo in cultivated places; near Maunabo on shady slopes between Emajagua and Punta del Naranjo; between Aibonito and Algarrobo in steep places at the roadside; near Barranquitas, on declivities at Isabon; between Aibonito and Coamo along roads; near Coamo, at Salinas; near Juana Diaz along roads; near Peñuelas on the top of Mount Vi and on plains around Mount Llano; near Guanica on gravelly banks around Barinas; near Mayaguez; near Rincon, in the mountains at Calvache and on the plains toward Aguada.—Cuba, Jamaica, St. Thomas, St. Croix, Guadeloupe, Dominica, Martinique, St. Vincent, Bequia (Kew Bull. no. 81, p. 246), Mustique (do.), Grenada, Central America, North America, South America.

Local name, *zarzabacoa*, *junquillo*.

10. **Desmodium spirale** (Sw.) DC.

(Urban, 293.)

Stems annual, 30 to 45 cm. high, slender, diffuse, slightly pubescent; petioles 1.2 to 2.5 cm. long; leaflets 3, the terminal one roundish or ovate, 2.5 to 5 cm. long; 1.2 to 2.5 cm. broad, the lateral ones smaller, subpapyraceous, both sides green, glabrous; pedicels 6.5 to 8.5 mm. long, spreading, very slender, glabrous; flowers in Porto Rican specimens always white; calyx 2.2 mm. long, deeply cleft; corolla slightly exceeding the calyx, greenish variegated with purple; pod 9 to 12 mm. long, 2.2 mm. wide; articulations 4 to 6, separated by very narrow spaces, often spirally twisted.

Near Bayamon; near Aibonito, at Cari-Blanco; near Coamo, in the valley of El Fuerte River, in meadows around Serillos at Salinas, and on grassy declivities toward Aibonito; near Juana Diaz, along roads around Escalabrado; near Peñuelas in the rocky plains at Tallaboa Alta; near Mayaguez; near Rincon, in plains at Barrio del Pueblo.—Cuba, Jamaica, St. Thomas, St. Croix (Eggers), St. John (Eggers), Antigua (Grisebach), Guadeloupe, Martinique (Duss), St. Vincent, Union (Kew Bull. no. 81, p. 245), Barbados, Trinidad (Grisebach). Common in tropical America; found also in the East Indies, Africa, and the Polynesian Islands.

Local name, *zarzabacoa espiral.*

11. **Desmodium scorpiurus** (Sw.) Desv.

(Urban, 293.)

Procumbent, rooting at the base; stem angular; leaflets 3, oval or oblong, 1.5 to 4 cm. long, 1 to 1.5 cm. wide, rounded at the apex, clothed on both surfaces with long, silky, appressed hairs; calyx 2.5 to 3 mm. deep, deeply cleft; corolla slightly exceeding the calyx, peach-colored, rose, or purple, becoming white; pod subsessile, uncinate-pubescent, slightly constricted at the dissepiments, the joints 2 to 7, oval-linear, minutely truncate at both ends, the terminal pointed.

In Bayamon around the church; near the town in fields; near Fajardo in cultivated places; between Aibonito and Algarrobo on precipices near the roads; between Aibonito and Coamo on declivities; near Coamo, on Mount Santana and in the valley of El Fuerte River; near Utuado, in ravines at San Andres; near Cabo Rojo, on hills toward Joyuda.—Cuba, Jamaica, Haiti, St. Thomas (Grisebach), St. Croix (Eggers), Antigua (Grisebach), Guadeloupe, Dominica (Grisebach), Martinique, St. Vincent, Grenada, Trinidad, Margarita.—Mexico, Central America, Ecuador, Peru.

A plant common in pastures.

Local name, *zarzabacoa cola de escorpion.*

44. ALYSICARPUS Neck.

Alysicarpus NECK. Elem. 3: 15. 1790.

Fabricia SCOP. Introd. 307. 1777, not Adans. 1763.

Hegetschweilera HEER & REGEL, Cat. Sem. Hort. Turic. 1842; Bot. Zeit. 1: 47. 1843.

Calyx deeply cleft, the lobes stiff and dry, striate, subequal, the two upper ones connate almost to the apex; standard orbicular or obovate, narrowed into a claw; wings obliquely oblong, adherent to the keel; keel obtuse, slightly incurved, usually with a little membrane on the outside on both margins; upper stamen free; ovary sessile or substipitate, multiovulate; style filiform, inflexed upwards; stigma terminal, sometimes oblique, usually broadly capitate; pod terete or somewhat compressed, equal or constricted between the articulations, these roundish or truncate at the ends and indehiscent; seeds ovate or orbicular.—Erect or diffuse herbs, glabrous or loosely hairy; leaves simple in our species (or very rarely 3-foliate); stipules membranous, scarious, acuminate, free or connate; flowers small, in terminal or rarely axillary racemes, the pedicels usually in pairs; bracts and bracteoles usually scarious, caducous.

1. **Alysicarpus nummularifolius** (L.) DC.[a]

(Urban, 294.)

A perennial, tufted or much branched at the base, the stems decumbent or ascending, from a few centimeters to 25 cm. long, glabrous or slightly pubescent; leaves on short slender petioles, the lower ones cordate-orbicular or oval, not 1.2 cm. long, the upper ones from oval-oblong to lanceolate-linear, and often 2.5 cm. long or more, all obtuse; calyx about 4.4 mm. long, the lobes very narrow, ending in a subulate almost hair-like point, the two upper ones less united than in most species; petals pale purple, becoming blue, scarcely exceeding the calyx; pod often 1.8 cm. long or rather more, obscurely wrinkled, the separation of the articulations marked by transverse raised lines, without any or rarely with a slight contraction.

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[a] Cook and Collins, p. 74, as *Alysicarpus vaginalis.*

Seemingly spontaneous near Bayamon in coast districts at Palo Seco; near Fajardo in rocky localities toward Ceiba; near Peñuelas, in rocky districts at Tallaboa Alta; near Cabo Rojo, in grassy places at the base of Mount Buenavista.—Jamaica, Haiti, St. Thomas, St. Croix, St. John, St. Kitts (Grisebach), St. Martin (Stockholm Herbarium), St. Bartholomew (do.), Antigua (Grisebach), Guadeloupe, Martinique, St. Vincent, Bequia (Kew Bull. no. 81, p. 246), Barbados, Grenada, Tobago, Trinidad. A common weed in the tropics of the Old World and introduced into America.

Local name, *yerba de contrabando*.

45. DALBERGIA L. f.

Dalbergia L. f. Suppl. 52, 316. 1781.

Calyx with the two upper teeth broader and the lowest rather longer than the others; standard broadly ovate or orbicular; wings oblong; keel slightly incurved, obtuse, its petals connate on the back at the apex; stamens all connate in a sheath slit above, or the upper one free or absent, or the sheath also slit below or the lowest sometimes also free; anthers small, erect, the cells dehiscing by a small apical slit; ovary stalked, biovulate; style almost straight; stigma small, terminal; pod orbicular or broadly oblong, flat or corky, indehiscent, 1-seeded, subemarginate at the upper suture.—Loosely branched or sarmentose shrubs; leaves imparipinnate; leaflets usually alternate, many or rarely reduced to 1; flowers in small panicles in the axils of the leaves.

KEY TO THE SPECIES.

Leaflets solitary, pale and tomentose beneath, rarely glabrescent, ovate, obtuse, acuminate; stamens 10; pod orbicular, 2.5 to 3 cm. in diameter, thick, subligneous.	1. *D. hecastophyllum*.
Leaflets 3 to 5, both sides glabrous, or with a few scattered hairs beneath, ovate, acuminate; stamens 9; pod roundish, oblong, blunt at both ends, 2.5 to 3 cm. long, 2 cm. wide, flat, shining, not much thickened, subligneous.	2. *D. monetaria*.

1. **Dalbergia hecastophyllum** (L.) Taub.

(Urban, 294.)

Shrub 2 to 3 meters high or tree 6 to 8 meters high, with firm woody branches; leaves unifoliolate, rarely bifoliolate; leaflets 7 to 10 cm. long, 4.5 to 5 cm. wide; petiole 1 cm. long; flowers in small cymose panicles, 2.5 to 5 cm. long, axillary; calyx campanulate, 5 mm. deep; corolla white, more than twice as long as the calyx.

Near San Juan, in thickets near the sea at Cangrejos; near Yabucoa in coast districts; near Ponce, in littoral thickets at Peñon; in coast districts near Mayaguez at Algarrobo; near Rincon; near Quebradillas.—South Florida (variety *psilocalyx* Radlk.), Cuba, Jamaica, Cayman (Hitchcock), Haiti, St. Thomas, St. Croix (Grisebach, Eggers), St. John, Antigua (Grisebach), Guadeloupe, Dominica (Grisebach), Martinique, St. Vincent, Bequia, Barabdos, Grenada, Tobago, Trinidad (Grisebach). Tropical America, especially near the sea, from south Brazil to Florida and Central America; also in west tropical Africa.

Dalbergia hecastophyllum (L.) Taub., a plant common in maritime thickets, has solitary leaflets, 10 stamens, and a pod that is nearly round, while the only other Porto Rican species, *D. monetaria*, has 3 to 5 leaflets, 9 stamens, and an oblong pod.

Local names, *maray-maray*, *palo de pollo*.

2. **Dalbergia monetaria** L. f.

(Urban, 295.)

Shrub 2 to 4 meters high; stems firm, woody, wide climbing; leaves 15 to 17 cm. long; leaflets 8 to 13 cm. long, 4 to 5.5 cm. wide; flowers in small panicles in the axils of the leaves, 1.5 to 3 cm. long; calyx 5 mm. deep, green; corolla more than twice as long as the calyx, white or yellow-white; anthers yellow, becoming brown; mature fruit brown.

Near Bayamon in mountain thickets and woods; Sierra de Luquillo, in the woods between Mavi and Mount Jimenez; near Juncos on the river bank; near Hato Grande, on the shady river bank opposite Mount Gregorio; near Yabucoa, on the edge of the forests at Jacana, in primeval forests at Guayavota, and in La Pandura at Santa Elena; near Aibonito; near Utuado, on the edge of the primeval forest at San Andres and in copses on the Rio Grande River at Saltillo Arriba; near Maricao in mountain woods; near Sabana Grande in the woods near the cataract of Estero River; near Mayaguez.—Cuba (Grisebach), Haiti, Guadeloupe, Martinique, St. Vincent, Grenada, Trinidad. Tropical America, north Brazil, Cayenne, Surinam, British Guiana.

Local names, *palo de brasilete*, *membrillo*.

46. **DREPANOCARPUS** G. F. W. Mey.

Drepanocarpus G. F. W. Mey. Prim. Fl. Esseq. 236. 1818.
Nephrosis Rich.; DC. Prod. **2**: 420. 1825.
Orucaria Juss.; DC. loc. cit.

Calyx campanulate, obtuse at the base, truncate at the apex, the teeth short; standard broadly ovate or orbicular, on the outside silky; wings oblong, often falcate; keel incurved, its petals connate at the back; stamens all connate in a sheath slit above, or both above and below, or more rarely the upper one free; ovary short-stalked, 1- (rarely 2-) ovulate; style slender, incurved; stigma small, terminal; pod falcate or suborbicular, compressed, thick-leathery, the upper suture intruse, the lower very much arched, with 1 large, reniform, compressed seed.—Erect tree or high-climbing shrub; leaves imparipinnate; leaflets usually alternate; stipules often spinous; flowers small or moderately large, purple, violet, or white; racemes short, fascicled or branched, axillary or in terminal panicles; bracts small, caducous; bracteoles under the calyx orbicular, persistent.

1. **Drepanocarpus lunatus** (L. f.) G. F. W. Mey.

(Urban, 296.)

An erect bush or small tree 2 to 3 meters high, with firm glabrous branches and with sharp, subfalcate spines from the nodes; petioles short; rachis 5 to 10 cm. long; leaflets 5 to 11, short-stalked, oblanceolate or oblong, 3.5 to 5 cm. long, blunt, rigidly coriaceous, both sides glabrous, the veins slightly raised; panicles copious, axillary and terminal; calyx glabrous, 6 mm. deep; corolla lilac, 6.5 to 8.5 mm. deep; pod 1.8 cm. broad, curved round so that the point touches the base, subligenous, the curve 3 to 3.5 cm. broad; pedicel 6 mm. long.

Near Bayamon, in the forest at Palo Seco; near Los Mameyes, in the Manglar swamp at La Carmelita; near Humacao, in littoral thickets near Punta Candela; near Maunabo, in thickets at Punta de Tuna; near Mayaguez.—Haiti, St. Thomas, St. Croix

(Eggers), Guadeloupe, Martinique, St. Lucia (Grisebach), St. Vincent (do.). Tropical America and western Africa.

This plant grows chiefly near the seashore and is noticeable on account of its short, sharply recurved spines and its pod, which is so bent that the point touches the base.

Local names, *palo de hoz*, *escambron*.

47. PTEROCARPUS L.

Pterocarpus L. Sp. Pl. ed. 2. **2**: 1662. 1763.
Moutouchi Aubl. Pl. Gui. **2**: 748. *pl. 299*. 1775.
Moutouchia Benth. Ann. Wien Mus. **2**: 94. 1838.

Calyx campanulate, often incurved, narrowed at the base, the two upper teeth more or less connate; standard broadly ovate or suborbicular; wings obliquely obovate or oblong; keel with its petals resembling or shorter than the wings, free or shortly connate on the back; stamens all connate in a sheath slit above or both above and below, or the upper one free; ovary sessile or stipitate, 2 to 6-ovulate; style filiform, slightly incurved; stigma small, terminal; pod compressed, indehiscent, orbicular or broadly ovate, more or less oblique, the style lateral or terminal, seminiferous in the center and there more or less incrassated, with a wing round the border; seeds 1 or 2, oblong or subreniform, if 2 separated by a hard septum.—Trees; leaves imparipinnate, leaflets alternate or almost opposite; flowers usually showy, yellow, rarely white or violet, in terminal or axillary, simple or compound racemes; bracts and bracteoles small, caducous.

1. **Pterocarpus officinalis** Jacq.[a]

(Urban, 296.)

Trees 25 to 30 meters high; leaflets 5 to 9, alternate, ovate or oblong, acuminate, shiny, 5 to 10 cm. long, 3 to 5.2 cm. wide, the veins on both sides conspicuous, subcoriaceous, glabrous, the petiolules 6 mm. long; flowers in compound racemes, yellow; calyx strongly oblique, 4 to 5 mm. deep, turning black in drying; corolla 1.3 cm. long; standard violet-colored on the edge, at the middle; pod glabrous, stipitate, corky-rugose, with a very oblique axis, 1-seeded, surrounded by a narrow wing, which is less distinct on the carinal edge, 3 to 5 cm. in diameter; wing 6.5 to 8.5 mm. broad on vexillar edge.

Near Bayamon in swampy localities; Sierra de Luquillo, in the woods of Mount Jimenez; near Mayaguez.—Jamaica (Grisebach), Guadeloupe, Dominica, St. Lucia, St. Vincent, Trinidad. Tropical America, Central America.

From *Pterocarpus officinalis*, the only species found in Porto Rico, is obtained a kind of kino known as "American dragon's blood." The tree is tapped and the sap collected, which when dried in the sun forms a hard mass that is used in medicine as an astringent and in tanning and dyeing. Large pieces of the substance are dark red, while smaller pieces are transparent.

Local name, *palo de pollo*.

48. LONCHOCARPUS H. B. K.

Lonchocarpus H. B. K. Nov. Gen. & Sp. **6**: 383. 1823.
Sphinctolobium Vog. Linnaea **11**: 417. 1837.
Neuroscapha Tul. Ann. Sc. Nat. II. **20**: 137. 1843.

Calyx often cupuliform, truncate, the teeth very short or wanting; standard orbicular, obovate, more rarely oblong, with 2 auricles at the base above the claw; wings obliquely oblong or falcate, slightly adhering to the keel above the claw; keel arcuate or nearly straight, the obtuse petals slightly cohering along the back; upper stamen free at the base, sometimes united with the others in a closed tube; ovary more or less stalked, biovulate or multiovulate; style filiform; stigma small, terminal; pod oblong or elongated, membranous or coriaceous, flat, indehiscent, the style scar terminal, persistent, sutures not winged but the upper sometimes laterally dilated; seeds 1 or 2, rarely more, flat, almost reniform or orbicular. Trees or woody climbers; leaves imparipinnate; leaflets opposite, rarely with stipels; stipules small, narrow; flowers violet, purple, or white, in simple racemes or raceme-like panicles, usually in pairs or clusters along the rachis; bracts and bracteoles usually small, deciduous, more rarely persistent.

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[a] Cook and Collins, p. 226, as *Pterocarpus draco*.

KEY TO THE SPECIES.

Flowers usually in pairs along the rachis; leaflets glabrous; standard usually sericeous on the outer surface; pod oblong or linear, the upper suture, especially near the seeds, with a projecting ridge; flowers rose-colored.
  Standard callous or auriculate at the base; leaflets 7 to 11. (Section NEUROSCAPHI Benth.) 1. *L. domingensis.*
  Standard not callous or auriculate at the base; leaflets 5 or 7. 2. *L. glaucifolius.*
Flowers many, usually small; standard glabrous or thinly silky on the outer surface; sutures of the pod not dilated or thickened. (Section DENSIFLORI Benth.) 3. *L. latifolius.*

1. **Lonchocarpus domingensis** (Pers.) DC.

(Urban, 296.)

Tree 15 meters high, young branches brown-tomentose becoming glabrous; leaves 17 to 19 cm. long; petiole about 3 cm. long; leaflets 7 to 11, most frequently 7, oval or oblong, 5 to 12 cm. long, 2.5 to 5 cm. broad, coriaceous, glabrous on both sides, the apex shortly acuminate, cuneate at the base; flowers in axillary racemes, pale violet to rose-colored, in clusters of 2 on a short branchlet, with a space between; racemes about 20 cm. long; pedicels 3 mm. long; calyx 6 mm. long, brown-tomentose; standard 1.4 mm. long, orbicular, the outside silky; pod usually 2 or 3-seeded, 5 to 10 cm. long, at the seeds about 2 cm. wide, constricted between the seeds, compressed, almost woody, slightly brown-tomentose or glabrous.

Near Guayanilla, close to the bank of the river at Los Indios; near Guanica, by the river at Barinas; near Cabo Rojo, around Hacienda Garcia; near Mayaguez.—Jamaica (Bentham), Haiti, Guadeloupe, Martinique.

2. **Lonchocarpus glaucifolius** Urb.

(Urban, 297.)

Shrub with climbing branches or tree 5 to 8 meters high; leaves 5 or 7-foliolate; leaflets elliptical or elliptical-oblong, rounded at the apex or shortly and obtusely acuminate, obtuse or rounded at the base, 4 to 13 mm. long, 2 to 7 cm. wide, glabrous, veins on the upper surface impressed; inflorescence 6 to 14-flowered, in lax racemes; calyx 4 mm. deep; flowers rose-colored; standard orbicular, 12 to 15 mm. long; wings 4 mm. wide; pod linear or broadly linear, 6 to 14 cm. long, 1 to 1.5 cm. wide, 2 to 7-seeded, coriaceous; seeds oval-reniform, 9 mm. long, 5 mm. wide, dark brown.

In the primeval mountain forests near Rincon at Calvache; near Aguada on Mount Piedra Blanca and in the mountain forests at Rio Grande; near Aguadilla, in the mountains at Espinal; near Quebradillas at Caño Grande. Indigenous.

Local name. *geno.*

3. **Lonchocarpus latifolius** (Willd.) H. B. K.

(Urban, 297.)

Tree 6 to 20 meters high; leaflets 5 to 9, oval-oblong, acuminate, paler and minutely puberulous beneath, or glabrescent, 5 to 15 cm. long, 2.5 to 5 cm. wide, subcoriaceous; inflorescence densely racemose, 7.5 to 12 cm. long, many-flowered; calyx 2.2 mm. deep; flowers purple, 8.5 to 11 mm. deep; standard thinly silky; pod oblong or broadly linear, 5 to 7.5 cm. long, 1.7 to 2.1 cm. broad, 1 or 2-seeded, not at all, or somewhat constricted between the seeds, flat, thin, glabrescent.

Near Bayamon, in woods at Palo Seco; Sierra de Luquillo in the woods on Mount Jimenez; near Quebradillas on the bank of the river; near Manati in thickets on the coast, and at Abra de los Muertos.—Cuba (Wright), Jamaica, Haiti, St. Kitts, Guadeloupe, Dominica, Martinique (Sieber), St. Lucia, St. Vincent, Trinidad. Common also in the adjoining parts of South America. Central America to Nicaragua. The hard wood is used in making furniture (Cook and Collins, p. 178.)

Local names, *palo hediondo*, *forte ventura*.

49. PISCIDIA L.

Piscidia L. Syst. ed. 10. **2**: 1155. 1759.

Calyx subcampanulate, with the teeth short and wide, the two upper ones slightly adhering; standard orbicular; wings oblong-falcate, adhering to the obtuse keel; petals of the keel cohering along the back; upper stamen free at the base, united with the others at the middle in a closed tube; ovary sessile with numerous seeds; style reflexed, filiform, the stigma small, terminal; pod linear, flat, each suture widening into 2-veined wings; seeds ovate, compressed.—Tree with imparipinnate leaves; leaflets opposite; flowers white and blood-red, in short panicles; bracts opposite on the pedicel, subelliptic, subcoriaceous, caducous.

1. **Piscidia piscipula** (L.) Sarg.

(Urban, 297.)

Tree 20 meters high; leaflets 3 to 5-jugate, pubescent or glabrescent, oblong or elliptical, pointed or blunt; flowers 1.2 to 1.6 cm. long; wings each 1.2 to 1.6 cm. broad, transversely striate, lacerate or repand; legume 5 to 10 cm. long, 8 mm. broad, puberulous; seeds 6 to 8, transversely oblong, black, 7 mm. long.

In thickets and forests on the coast near Fajardo and near Salinas de Cabo Rojo.—South Florida (Chapman), Florida Keys (Sargent), Bahama (Grisebach), Jamaica, Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Martin (Stockholm Herbarium), St. Bartholomew (do.), Antigua (Grisebach), Guadeloupe, St. Lucia (Grisebach), St. Vincent, Barbados, Grenada, South Mexico. Southern parts of North America.

Local name, *ventura*.

50. ANDIRA Lam.

Vouacapoua Aubl. Hist. Pl. Gui. **2**: Suppl. 9. *pl. 373.* 1775.
Andira Lam. Encyc. **1**: 171. 1783.

Calyx broadly campanulate or subturbinate, truncate, with short indistinct teeth; petals clawed; standard suborbicular; wings and petals of the keel nearly straight, oblong, obtuse, the latter imbricate but not connate on the back; upper stamen free, or rarely connate with the rest; ovary stipitate or rarely sessile, 2 to 4- (rarely 1-) ovulate; style short, incurved; stigma small, terminal; pod drupaceous, ovoid or obovoid, often somewhat compressed, with a more or less fleshy mesocarp and a thick subligneous endocarp; seeds 1, pendulous.—Strong trees; leaves imparipinnate; leaflets opposite, rarely alternate, often stipellate; flowers rose-colored or violet, fragrant, in terminal pyramidal panicles, subsessile, usually crowded; bracts and bracteoles small, deciduous.

1. **Andira jamaicensis** (W. Wright) Urb.[a]

(Urban, 298.)

Tree 10 to 20 meters high with firm woody branches, the young twigs slightly gray-pubescent; petioles 5 to 7.5 cm. long; leaflets 9 to 13, the pairs more than 2.5 cm. apart, oblong or lanceolate, or the terminal one obovate, 5 to 7.5 cm. long, 1.5 to 2.5 cm. wide, acuminate or subacute, the base scarcely rounded, subsessile, subcoriaceous, both sides glabrous, dark green, shining; flowers in pyramidal panicles, 15 to 30 cm. long, with distant, spreading, stalked, racemose, closely flowered branches; calyx subsessile, silky, about 4.5 mm. deep, brownish red; corolla reddish, violet, or pale purple, 13 to 15 mm. deep, the standard 6.5 to 8.5 mm. broad; ovary stalked, glabrous or slightly ciliate, 3 or 4-ovulate; legume green, subrotundate, about 2.5 cm. in diameter, obtusely carinate; or shortly ovate, or obovate, 3.5 to 4 cm. long, slightly or not at all carinate.

Near Bayamon in woods; Sierra de Luquillo, in woods between Mavi and Mount Jimenez; in the calcareous mountains near Juncos; near Coamo in woods at Pedro Garcia and at Los Baños; between Coamo and Aguas Buenas on the roadside; near Yauco; near Guanica on Mount Puerco and at Barinas; near Mayaguez; near Maricao, in the forests of Mount Montoso; near Utuado in the rocky mountains at Los Angeles.—Cuba, Jamaica, Haiti, and in related forms (variety *sapindoides* (Benth., Griseb.), with larger flowers and longer pedicels, St. Thomas, St. Croix, St. John (Eggers), St. Kitts (Grisebach), Antigua, Guadeloupe, Dominica, Martinique, St. Lucia, St. Vincent, Tobago, Trinidad (Sieber). Tropical America and west tropical Africa; very abundant in Central America, Guiana, Venezuela, north Brazil, and eastern Peru.

The Brazilian and west African specimens are generally rather longer-flowered and stiffer-leaved than those from Guiana, the West Indies, and Central America; but no tangible characters nor constant size in the flowers can be found to separate them even into marked varieties.

Local names, *moca*, *moca blanca*.

51. ABRUS L.

Abrus ADANS. Fam. **2**: 327. 1763.
Hoepfneria VATKE, Oester. Bot. Zeitsch. **29**: 222. 1879

Calyx campanulate, truncate or shortly and broadly toothed; standard ovate, the short claw adhering to the base of the staminal tube; keel much curved, the petals united from the base, often longer than the wings; stamens 9 united in a sheath open on the upper side, the upper one deficient; ovary sessile, with indefinite ovules; style short, incurved; stigma terminal; pod oblong or linear, flat, 2-valved, with cellular partitions between the seeds.—Shrubs or undershrubs; stems usually twining or trailing, woody at the base; leaves paripinnate, the leaflets many-jugate, the common petiole ending in a short point; flowers small, rose-colored or white, in clusters on lateral thickened nodes or in axillary or terminal racemes; bracts small, often persistent; bracteoles 2 on the calyx.

1. **Abrus precatorius** L.

(Urban, 298.)

Shrub with slender woody wide-climbing glabrous or slightly pubescent branches; leaves abruptly pinnate, 4 to 8 cm. long; leaflets 10 to 15-jugate, oblong or obovate,

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[a] Cook and Collins, p. 80, as *Andira inermis*.

1 to 2 cm. long, blunt, subsessile, glabrous or the lower side slightly silky; racemes axillary or terminal, dense, stalked. 5 to 7.5 cm. long, the flowering part 2.5 cm. long; calyx truncate, thinly silky, the teeth very short; corolla 9 mm. long, reddish, rarely white or purple; pod sessile, 2.5 to 3.5 cm. long, 1.2 cm. broad. oblong, rostrate, subcoriaceous, flat, 2-valved, with cellular partitions between the seeds, glabrous when mature; seeds 4 or 5, globose, shining, scarlet, with a black spot at the base.

Near Bayamon in sandy soil; near Salinas de Cabo Rojo; near Mayaguez, on hedges at Guanajibo.—Bahama, Cuba, Jamaica, Haiti, St. Thomas (Eggers), St. Croix, St. John (Eggers), St. Bartholomew (Euphrasén), Antigua (Grisebach), Guadeloupe, Dominica, Martinique, St. Vincent, Barbados (Maycock), Tobago, Trinidad. Widely distributed through the Tropics, but often planted.

The brilliant red seeds with a black spot at the hilum are strung by the women of Hindustan and are used instead of beads for ornaments for the neck and also for rosaries, hence the name "pater noster herb." The seeds are extremely poisonous when taken in large quantities, and in India they have played an important rôle in many a crime.

Local names, *peronia*, *peronilas*.

52. CLITORIA L.

Clitoria L. Sp. Pl. 2: 753. 1753.

Calyx tubular, the 2 upper lobes slightly connate, the lowest narrow; standard large, erect, open, narrowed at the base without auricles; wings shorter, spreading, adhering to the keel in the middle; keel shorter, incurved, acute; upper stamens free or more or less united with the others; anthers uniform; ovary stipitate, with several ovules; style elongated, incurved, more or less dilated upward and bearded longitudinally on the inner side; pod linear, flattened, the upper or both sutures thickened, the sides flat or convex, occasionally bearing a raised longitudinal rib, dehiscent; seeds globose or flattened.—Herbs or shrubs, short and erect or with long twining branches; leaves pinnate, with 3 or several leaflets or occasionally only 1; stipules persistent, striate; flowers often large, purple, blue, white, or red, often two-colored, solitary or clustered in the axils or in pairs crowded in short racemes; bracts stipule-like, persistent, the lower ones in pairs, the upper united into one.

This genus is readily distinguished by its large tubular calyx.

KEY TO THE SPECIES.

Leaflets 2 or 3-jugate (rarely 4 or 5), ovate, blunt or oval; peduncle short, 1-flowered; bracteoles suborbicular, about one-fourth as large as the calyx; calyx lobes lanceolate, acuminate; legume linear, pubescent. (Section TERNATEA Benth.) 1. *C. ternatea.*

Leaflets only 3. (Section NEUROCARPUM Benth.)

  Stem twining; leaflets acute. 2. *C. rubiginosa.*

  Rhizome woody; stem erect, nearly simple, ascending; leaflets obtuse, retuse, or emarginate. 3. *C. laurifolia.*

1. Clitoria ternatea L.

(Urban, 299.)

Herbaceous, suffrutescent; stem twining; leaflets 2 to 3 cm. long, about 1.5 cm. wide; peduncle 2 to 4 mm. long; flowers large, resupinate, blue and white; calyx 1.5 cm. deep; standard 5 cm. long; pod 6 to 13 cm. long, 1 cm. wide.

Cultivated and seemingly wild near Bayamon; near Fajardo in Bromelia copse toward the sea; near Mayaguez, toward Guanajibo.—Bahama, Cuba, Jamaica, Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Bartholomew (Stockholm Herbarium), St. Kitts, Antigua (Grisebach), Guadeloupe, Dominica, Martinique, St. Vincent, Barbados (Grisebach), Grenada, Tobago, Margarita. Native country probably east Africa (Bentham).

Local names, *bejuco de conchitas*, *papito*.

Two of the Clitoria species found in Porto Rico are climbing plants, *C. ternatea* and *C. rubiginosa*. The former, however, has imparipinnate leaves, 2 or 3-jugate leaflets, blue and white resupinate flowers, and large bracteoles, while the latter has trifoliolate leaves, and a pod with a prominulous midrib, a peculiarity that rarely occurs.

The third Clitoria species, *C. laurifolia*, is an erect shrub, with a racemose inflorescence, while the peduncle of *C. ternatea* and *C. rubiginosa* has 1, or at most 3, flowers. The roots, leaves, and seeds have emetic properties and are used in popular medicines, while the flowers are often employed to color viands and beverages blue.

C. ternatea is widely distributed in the Tropics, and is cultivated in the glass houses of colder countries on account of its showy flowers.

2. **Clitoria rubiginosa** Juss.

(Urban, 299.)

Stem twining; leaflets ovate-oblong, acute, villous or sericeous below, 3 to 10 cm. long, 1.5 to 3 cm. broad; peduncle 3 or fewer-flowered, 4 to 13 cm. long; flower large, purple-variegated; bracteoles ovate-oblong, 3 or 4 times exceeded by the calyx tube; calyx 2 to 5 cm. long; calyx lobes lanceolate, acuminate, almost one-half the length of the tube; standard 5.5 cm. long; legume 3.5 to 5 cm. long, 1 cm. wide, convex, each valve usually with a prominent midrib, glabrescent; seeds globose.

Near Bayamon on hedges; between Aguas Buenas and Caguas along roads; near Cayey, at Campito; near Salinas de Cabo Rojo on the edge of the forests; near Mayaguez, on the sides of Mount Mesa; near Aguada, in the forests at Piedra Blanca.—Cuba (Grisebach), Jamaica (do.), Haiti, Guadeloupe, Martinique, St. Vincent, Tobago, Trinidad (Grisebach). Widely distributed in tropical America.

Local name, *flor de pito*.

3. **Clitoria laurifolia** Poir.

(Urban, 300.)

Stem erect, herbaceous, pubescent, 30 to 60 cm. high; leaflets 3, oblong, rarely more than 7.5 cm. long; apex very obtuse, retuse, or emarginate, pubescent beneath; peduncle 1 or 2-flowered; bracteoles ovate, much exceeded by the calyx; flowers white; calyx about 2.4 to 2.8 cm. long, silky-pubescent, rarely glabrous; teeth ovate-lanceolate, acute or acuminate, 0.8 to 1 cm long, the upper more or less connate, the lowest longer and acuminate; corolla about 5 cm. long; legume 2.5 to 6.25 cm. long, stipitate, with a prominent midrib, rarely destitute of it; seeds ovoid-globose.

Near Bayamon in sandy soil, near Dorado in plains near the coast.—Cuba, Haiti (Bentham), Trinidad. Tropical South America.

53. **CENTROSEMA** Benth.

Bradburya RAF. Fl. Ludov. 104. 1817.
Centrosema BENTH. Ann. Wien. Mus. **2**: 117. 1838.

Calyx shortly campanulate, the segments subequal, the two upper sometimes connate; standard broadly orbicular, spurred on the back over the short, arched, complicate claw, rarely with a more or less distinct gibber (tubercle); wings arcuate, obovate; keel hardly shorter than the wings, wide, inflexed; upper stamen free or more or less connate with the others; ovary subsessile, multiovulate; style inflexed, more or less dilated at the apex; stigma terminal, slightly bearded; pod subsessile, linear, compressed, with incrassate sutures, 2-valved, valves with a prominent nerve on both sides near the margin, or winged near the lower suture; seeds obliquely oblong.—Twining or prostrate herbs or undershrubs; leaves pinnate; leaflets 3, rarely 1, 5, or 7, sometimes so close together that they appear digitate; stipules persistent, striate; flowers showy, often large, whitish, rose-colored, violet, or bluish, on axillary peduncles, 1 to numerous; lower bracts of the same form as the stipules, in pairs or connate above, bearing 1 or 2 flowers in the axils; bracteoles appressed to the calyx, striate, larger than the bracts.

The genus Centrosema strongly resembles Clitoria in habit, but can be distinguished from it by the spurred standard and the much shorter calyx.

KEY TO THE SPECIES.

Upper calyx segments much shorter than the tube.
    Leaves 16 to 27.5 cm. long, turning black in drying; terminal leaflet 8.5 to 12 cm. long, broadly ovate; bracteoles ovate, twice as long as the calyx; calyx teeth very short, unequal; pod 15 cm. long, 11 to 13 mm. wide; ribs of the legume valves prominulous, 3.3 mm. distant from the margin; corolla white, variegated with bright purple and yellow. 1. *C. plumieri.*
Upper calyx segments longer, rarely a little shorter, than the tube.
    The upper calyx segments equal to the tube, connected below the summit, inferior calyx lobe longer than the tube; leaflets 5 to 7.5 cm. long, 2.5 to 3.7 cm. wide, ovate; bracteoles ovate, as long as the calyx; pod 5 to 6.5 mm. wide, the ribs of the legume valves 2.2 mm. from the margin. 2. *C. pubescens.*
    The upper calyx segments longer than the tube, free or connate at the base; leaflets 3.5 to 5 cm. long, 1.8 to 2.5 cm. wide; bracteoles ovate, somewhat exceeded by the calyx; pod 4.4 mm. wide; ribs of the legume valves juxtamarginal. 3. *C. virginianum.*

1. **Centrosema plumieri** (Turp.) Benth.[a]

(Urban, 300.)

Stem twining, suffrutescent at the base; peduncle 2 or 3- (rarely 5 or 6-) flowered; calyx 6.5 mm. long; standard spurred above the calyx, 4 cm. in diameter, orbicular; wings narrowly oblong, falcate, shorter than the standard; keel large, broader and shorter than the wings; legume 15 cm. long, 1.3 cm. wide, erect or slightly curved.

Near Bayamon in thickets.—Cuba, Jamaica, Haiti, St. Thomas, St. Kitts (Grisebach), Antigua, Martinique, St. Vincent, Grenada, Trinidad (Grisebach). Indigenous in tropical America.

Centrosema plumieri is common on fences in the West Indies. The leaflets and flowers are larger than those of the other two species of Centrosema found in Porto Rico. The roots contain a volatile oil and a resin that is much used in popular medicine.

Local name, *conchita de Plumier* (Cook and Collins).

2. **Centrosema pubescens** Benth.[b]

(Urban, 300.)

Stem twining; flowers few, at the apex of the peduncle, yellow; calyx 6.5 to 11 mm. deep; standard 2.5 cm. in diameter; keel wide, incurved; pod 15 to 20 cm. long, 3 to 6.5 mm. wide.

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[a] Cook and Collins, p. 94, as *Bradburya plumieri.*

[b] Cook and Collins, p. 94, as *Bradburya pubescens.*

Near Bayamon in thickets; near Coamo, in the valley of El Fuerte River; near Pepino; on declivities at Eneas; near Maricao in thickets on the river bank; near Cabo Rojo in copses; near Mayaguez; near Añasco, in thickets at Calvache; near Rincon in coast districts; near Aguadilla, at Barrio Victoria.—Cuba, Jamaica, Haiti, Antigua (Grisebach), Guadeloupe, Martininque, St. Vincent, Trinidad. Widely distributed in tropical America.

Local name, *flor de pito.*

3. **Centrosema virginianum** (L.) Benth. [a]

(Urban, 300.)

Stems slender, firm, herbaceous, widely climbing; peduncle axillary, 1, sometimes 4-flowered; calyx 9 to 12 mm. deep; standard 2.5 cm. in diameter; flowers blue or white becoming blue; pod 7.5 to 10 cm. long, 3.3 to 4.4 mm. broad, nearly straight.

Near Bayamon in thickets and grassy places, near Yabucoa, on the declivities of Mount Canto de Gallo; near Cayey, at Morillos Brook; near Guanica, in meadows at Montalba and between La Boca and Barinas; near Salinas de Cabo Rojo on the edge of the woods; near Mayaguez, on the declivities of Mount Mesa; near Utuado, in thickets at Cayuco.—Bermuda (Hemsley), Bahama, Cuba, Jamaica, Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Martin (Stockholm Herbarium), St. Bartholomew (do.), St. Kitts, Antigua (Grisebach), Guadeloupe, Dominica (Grisebach), Martinique, St. Vincent, Bequia (Kew Bull. No. 81, p. 246), Mustique, Canouan (do.), St. Lucia (Grisebach), Barbados, Grenada, Tobago, Margarita. A common tropical American species, extending north to Maryland. Also in western tropical Africa.

Centrosema virginianum resembles *C. pubescens* closely, but has a much narrower pod.

Local name, *conchita virginia* (Cook and Collins).

3a. **Centrosema virginianum angustifolium** (DC.) Griseb.

(Urban, 301.)

Leaflets linear, or the inferior oblong.

Near Mayaguez, on Mount Mesa.—Bahama, Cuba, Jamaica, Haiti, St. Martin (figure in Stockholm Herbarium), Antigua (Grisebach), Martinique.

54. TERAMNUS P. Br.

Teramnus P. Br. Hist. Jam. 290. 1756.

Calyx campanulate, the two upper teeth connate or separate, the others subequal; standard obovate, narrowed at the base, exappendiculate; wings narrow, adhering to the keel; keel shorter than the wings, almost straight, obtuse; stamens all connate, the 5 alternate anthers small, abortive; ovary sessile, multiovulate; style short, thick, beardless; stigma capitate; pod linear, 2-valved, septate between the seeds, rostrate.—Slender twining herbs; leaves pinnate; leaflets 3; stipules small; flowers minute, in racemes or fascicles in the axils or in pairs or fascicles along the rachis; bracts small; bracteoles linear or lanceolate, striate.

1. **Teramnus uncinatus** (L.) Sw.

(Urban, 301.)

Twining suffrutescent slender herbs; leaves pinnately 3-foliolate; petioles 4 to 6 cm. long; leaflets oblong-lanceolate, 5.5 to 8 cm. long, 2.25 to 3 cm. wide, pubescent above, sericeous beneath; flowers in long racemes, small, white or rose-colored, later pale blue; calyx 5-parted, lobes equal; standard obovate, 6.6 mm. long, wings narrowly oblong; keel shorter than the lobes of the calyx; pod 3.5 to 5 cm. long, 3.5 mm. wide, slightly falcate, rusty-hirsute, terminated by a recurved beak; seeds yellow, oblong.

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[a] Cook and Collins, p. 94, as *Bradburya virginiana.*

Near Bayamon in grassy tracts; near Aibonito at Algarrobo; on precipices between Aibonito and Coamo; near Barranquitas; in thickets on the Isabon River; near Utuado in thickets at Los Angeles; near Pepino, on shady declivities at Eneas; near Maricao in thickets on the river bank; near Mayaguez among shrubs in moist meadows; near Cabo Rojo in thickets.—Cuba, Jamaica, Haiti. Tropical America.

In the Antilles the leaves of *T. uncinatus* are used as a purgative and the flour of the seeds for poultices to reduce inflammation.

Local name, *cresta de gallo blanco.*

55. ERYTHRINA L.

Erythrina L. Sp. Pl. **2**: 706. 1753.
Mouricou ADANS. Fam. **2**: 326. 1763.

Calyx bilabiate or spathaceous, slit down to the base on the lower side, the teeth short or elongated; standard ample and elongated, erect or patent, subsessile or furnished with a claw, not appendiculate at the base, wings short or none; keel much shorter than the standard, shorter or longer than the wings, its petals often free; upper stamen free or connate with the others below; anthers uniform; ovary stalked, multiovulate; style subulate, incurved, beardless, with a small, terminal, subcapitate stigma; pod stalked, linear, falcate, narrowed at the base and apex, compressed or subterete, much constricted between the seeds, both sutures or only the upper one splitting; seeds distant, ovoid or oblong.—Trees, or at times almost herbaceous shrubs, with thick, often aculeate branches; leaves pinnate with 3 leaflets; stipules glandular, at the base of each leaflet; flowers large, usually scarlet, axillary or terminal, in racemes or in small clusters in the axils; bracts and bracteoles small or wanting.

KEY TO THE SPECIES.

- Calyx broadly campanulate; keel gamopetalous; standard long-stipitate. 1. *E. glauca.*
- Calyx subtubulose, truncate; standard sessile or subsessile, oblong.
    - Keel petals free; keel short, a little shorter than the calyx; leaves chartaceous; seeds scarlet with a black spot. 2. *E. corallodendron.*
    - Keel gamopetalous, long, only a little shorter than the standard; leaves membranous or subpapyraceous; seeds dark brown. 3. *E. micropteryx.*

1. **Erythrina glauca** Willd.

(Urban, 302.)

Tree 13 meters high; leaves 20 to 30 cm. long; leaflets broadly ovate, obtuse at the apex, rotundate at the base, 9 to 12 cm. long, 8 to 8.5 cm. wide, coriaceous or chartaceous; racemes 15 to 20 cm. long; calyx 1 to 2 cm. deep; flowers deep saffron yellow; standard 5 to 6.5 cm. long; wings 2.5 cm. long; keel 3 to 3.5 cm. long; pod sublignose, 17 to 25 cm. long, 1.5 cm. wide; seeds dark brown.

Near Bayamon, on the bank of the river around Guinabo.—Cuba (Grisebach), Guadeloupe, Martinique, St. Vincent, Venezuela. Tropical America.

The saffron-yellow flowers and the very long (sometimes 25 cm.) woody pods of *E. glauca* are very striking. It has by far the deepest calyx of all the Porto Rican species.

Local name, *bucago.*

2. **Erythrina corallodendron** L.

(Urban, 302.)

Shrub 3 to 4 meters high, climbing, or tree 3 to 6 meters high, armed; leaflets broadly ovate-rhomboid, 1 to 1.5 cm. wide, 5 to 14.5 cm. long; flowers in axillary racemes 12 to 35 cm. long, coral-colored; standard 5 to 6.5 cm. long; calyx 8.5 to 10 mm. long, a little exceeded by the wings; pod 10 cm. long, 1 cm. wide.

Near Bayamon, in calcareous mountains; near Sabana Grande, in thickets on the rocky banks of Estero River near the cataract; near Añasco; near Rincon, in thickets on the shore at Cabo San Francisco.—Bermuda (introduced, Hemsley), Cuba, Jamaica (in the form *grandiflora*), Cayman (Hitchcock), St. Thomas (Eggers), St. Croix (do.), St. John, St. Bartholomew (Wikström), St. Kitts (Euphrasén), Antigua (Grisebach), Guadeloupe, Martinique, St. Vincent, Grenada, Tobago (in the form *grandiflora*), Mexico. Tropical America.

Erythrina corallodendron on account of the size of its flowers is a very noticeable tree. It differs from *E. micropteryx* in having a short keel and red seeds. The three Erythrina species of Porto Rico are at first armed, later they become glabrous.

From the soft, corky wood of *E. corallodendron*, coral wood, arbol madre of the Mexicans, are manufactured corks, light ladders, etc.

Local name, *bucare*.

3. **Erythrina micropteryx** Poepp.

(Urban, 301.)

Tree 15 to 20 meters high, armed; leaflets 11 to 16 cm. long, 7 to 12 cm. wide, orbicular-oval, obtuse or abruptly acuminate; flowers in racemes, bright red; calyx 6 mm. deep; standard elliptical or narrowly oval, 3.5 to 4.2 cm. long; wings twice as long as the calyx, obovate or oval-elliptical; keel a little shorter than the standard, bidentate; pod 7 to 13 cm. long, chartaceous; seeds dark brown.

Cultivated for shading coffee plantations and seemingly wild near Bayamon; near Cayey, at Quebrada Arriba; near Adjuntas, on Mount Capaes; near Utuado, at Salto Arriba; near Lares, at Mirasol and at Espino; near Quebradillas and near Toa Alta.—Cuba, Jamaica, Guadeloupe, Martinique, Trinidad. Indigenous in Peru.

The long keel of *E. micropteryx* makes it easy to distinguish from the other Porto Rican species; the brown seeds, from *E. corallodendron*.

Local names, *bucare, palo de boyo;* Cuba, *peñon de Cuba* (Eggers); Guadeloupe, *immortel jaune* (Duss); Martinique, *erythrine de cayenne* (Hahn); Peru, *a'ma-sísa* (Spruce).

56. **RUDOLPHIA** Willd.

Rudolphia WILLD. Ges. Naturf. Fr. Berlin Neue Schrift **3**: 451. 1801.

Calyx tubuliform, the 2 upper segments connate or subconnate, the 2 lateral much smaller, the lowest one cuspidate and slightly arcuate; standard oblong, plicate; the wings and the free petals of the keel narrow and much shorter than the standard; upper stamen free; ovary stipitate or sessile; style more or less dilated in the middle; stigma terminal, subcapitate; pod elongated, flat, tipped with the persistent base of the style, 2-valved; valves finally tortuose, pulpy within; seeds flat, obovate.—Twining undershrubs or herbs; leaves with one leaflet; flowers elongated, purple, red, or flesh-colored, in axillary racemes or fasciculate on the rachis; bracts and bracteoles small and caducous.

1. **Rudolphia volubilis** Willd.

(Urban, 302.)

Twining; leaflets cordate, rarely broadly ovate, 5 to 10 cm. long, 3.5 to 7 cm. wide, truncate at the base, acuminate; pedicels 5 to 7 mm. long; calyx purple, 2.0 to 2.5 cm. long; corolla coral-colored, pale purple or blood-red; standard 4.0 to 4.5 cm. long, 1.2 to 1.3 cm. wide; wings 1.5 to 1.8 cm. long, 0.7 to 1 mm. wide; keel petals 1.2 to 1.6 cm. long, 0.7 to 1 mm. wide.

In the primeval forest, not unusual—e. g., near Bayamon; near Rio Blanco; in Sierra de Luquillo on Mount Jimenez; Sierra de Naguabo on Mount Piedra Pelada; near Yabucoa, at Guayabota and on Mount Piedra Azul; near Hato Grande on Mount Gregorio; near Aibonito, at Guyon; near Cayey, on Mount Torito; near Adjuntas on Mount Serrote; near Peñuelas, at Las Cruces; near Maricao on Mount Alegrillo; near Mayaguez on Mount Mesa; in Sierra de Lares at Guajataca. Indigenous.

Local names, *bejuco colorado, bejuco de alambre, bejuco prieto*

57. **MUCUNA** Adans.

Mucuna ADANS. Fam. 2: 325. 1763.

Calyx broadly campanulate, very unequally toothed, the upper tooth (consisting of 2 combined) broader, the lowest longer; standard folded together, shorter than the wings, with inflexed auricles at the base; wings oblong or ovate, incurved, often adhering to the keel; keel equaling or longer than the wings, incurved at the apex, acute or rostrate; upper stamen free, the rest connate; anthers alternately longer and fixed at the base and shorter and versatile, often bearded; ovary sessile, pauciovulate; style filiform; stigma small, terminal; pod thick, linear or ovate-oblong, often clothed with stinging hairs, 2-valved, septate between the seeds, the valves coriaceous, plane or variously costate or lamellate, sometimes winged.—Climbing herbs or shrubs (one species erect); leaves pinnate; leaflets 3, with stipels; stipules caducous; flowers usually large, purple, red, or yellowish green, rarely light green, in axillary racemes or fasciculate at the end of the peduncle; bracts usually small, seldom large, usually caducous.

KEY TO THE SPECIES.

Pod oblong, nearly straight, with close, broad, irregular, coriaceous undulated lamellations and yellow bristly hairs in the hollows, 2 or 3-seeded; leaflets papyraceous, the upper surface with a few deciduous adpressed bristly hairs, under surface more or less silky, central one ovate-oblong, cuspidate; flowers in capitate heads on firm axillary peduncles; corolla sulphur-yellow. (Section CITTA DC.)	1. *M. urens.*
Pod linear, curved, longitudinally ribbed, densely clothed with brown silky bristles, 5 or 6-seeded; leaflets membranous, the central one ovate-rhomboidal broad, bluntish with a mucro, the upper surface glabrous; flowers in short-stalked copious racemes; corolla deep dark purple. (Section STIZOLOBIUM DC.)	2. *M. pruriens.*
Leaflets ovate or oval-oblong, glabrous; peduncle long, slender, pendulous; pod compressed, flat, without lamellae, often very long, many-seeded, constricted between the seeds; seeds round; hilum linear. (Section CARPOPOGON.)	3. *M. altissima.*

1. **Mucuna urens** (L.) DC.

(Urban, 303.)

Stem woody, slender, wide climbing; leaflets 7.5 to 12.5 cm. long, 7.5 to 8 cm. wide, calyx broadly campanulate, 1.5 to 2 cm. deep; corolla with wings and keel 5 cm. or more long, standard much shorter; pod 10 to 20 cm. long, 3.5 to 4 cm. wide, armed with stinging bristles.

Near Lares in the coffee plantations at Juncal; near Mayaguez; near Aguada, in thickets at Rosario.—Cuba (Richard), Jamaica, Cayman (Fawcett), Haiti, Guadeloupe, Martinique, Tobago. Tropical America, tropical West Africa.

Mucuna urens is readily distinguished from *M. pruriens* by its yellow flowers and its long pod (over 20 cm.) which has close, broad, irregular, coriaceous, undulate lamellations. The seeds are very large and have a broad black band. When polished they are often used for ornaments.

The Mucuna species can be recommended in the Tropics as ornamental plants, but *M. urens* and *M. pruriens* must be touched with care on account of the hairs of the pods, which have a most irritating effect upon the skin.

Local names, *ojo de buey*, *matos*, *matos del monte.*

2. **Mucuna pruriens** (L.) DC.

(Urban, 303.)

Stems herbaceous, wide-climbing; leaflets 8 to 14 cm. long, 5 to 7 cm. wide; flowers dark violet; calyx about 1 cm. deep; corolla 3 to 3.5 cm. deep, the standard half as long as the wings; pod 5 to 8 cm. long, 1.5 to 1.75 cm. wide, densely clothed with brown silky bristles.

Near Aguas Buenas on the brook near the town; near Juncos, at Valenziano Arriba climbing on high trees; near Guayama, in mountain woods beyond Guamani; near Coamo, in the valley of El Fuerte River; near Peñuelas, on the bank of the river toward Tallaboa Alta; near Cabo Rojo in thickets; near Mayaguez, at Algarrobo; near Rincon in thickets on the shore. Cuba (Grisebach), Jamaica, Cayman (Hitchcock), Haiti, St. Thomas (Eggers), St. Croix (do.), St. John (do.), Guadeloupe, Martinique, St. Vincent, Grenada, Tobago. Cosmopolitan in the Tropics.

Mucuna pruriens differs markedly from *M. urens* in that it has purple flowers and a much smaller, longitudinally ribbed pod.

The root and the seeds have long been valued in East Indian medicine, and in the West Indies and in Europe the hairs were formerly considerably used medicinally. The young tender pods are cooked and eaten as a vegetable.

Local name, *pica-pica* (Urban); cowhage or cowitch (Cook and Collins).

3. **Mucuna altissima** (Jacq.) DC.

(Urban, 304.)

Twining; leaflets glabrous, ovate or oval-oblong, 7.5 to 12.5 cm. long, 2.5 to 6 cm. wide, membranous; petiole slender, 7.5 to 12.5 cm. long; peduncle 30 to 120 cm. long, racemes short; calyx sericeous, 4-toothed; the three superior teeth small or obsolete, the inferior longer; flowers dark violet or pale flesh-colored; corolla 3.6 cm. long; standard ovate-oblong, nearly as long as the wings; beak of the keel cartilaginous, bluntish, equaling the wings; legume 15 cm. long, 3.7 cm. broad below its pointed top, with numerous, transverse, convex lines, compressed, spathulate, oblong, hirsute, callous on the margins; seeds orbicular, compressed (1.6 to 2 cm. in diameter), almost wholly surrounded by the raphe.

Near Bayamon in forests on the bank of the river; Sierra de Naguabo, near Minas de Cobre at Rio Blanco; near Yabucoa, in the primeval forest on Mount Sombrero at La Pandura; between Adjuntas and Ponce, in shady localities by the river at Coral Viejo.—Cuba, Jamaica (Grisebach), Haiti, St. Kitts, Guadeloupe, Martinique, St. Vincent. Panama, Brazil.

Local names, *mato*, *tortera*.

58. CALOPOGONIUM Desv.

Calopogonium DESV. Ann. Sc. Nat. **9**: 423. 1826.
Stenolobium BENTH. Ann. Wien. Mus. **2**: 125. 1838.
Cyanostremma BENTH.; HOOK. & ARN. Bot. Beech. 415. 1841.

Calyx campanulate or short tubuliform, the 2 upper teeth free or more or less connate; standard obovate, the base with inflexed auricles; wings narrow, adhering to the keel; keel obtuse, usually shorter than the wings; upper stamen free; ovary sessile, multiovulate; style slender; stigma terminal, capitate; pod linear, compressed or at last convex, 2-valved, septate; seeds orbicular, somewhat flat.—High-climbing herbs or undershrubs; leaves pinnate; leaflets 3, stipellate; flowers small or moderately large, narrow, blue or violet, subsessile, fascicled, forming an elongated raceme; bracts or bracteoles small, caducous.

1. Calopogonium orthocarpum Urb.

(Urban, 304.)

A twining plant with subligneous stem; branches, petioles, and peduncles densely rusty-pilose; stipules oblong-lanceolate or lanceolate, acuminate; terminal leaflet ovate-rhomboid or short-ovate, acute; leaflets 3.5 to 10 cm. long, 3 to 8 cm. wide, both sides with appressed hairs; inflorescence racemose, sometimes elongated, sometimes very short, up to 15 cm. long; calyx 6 to 8 mm. deep, campanulate, the teeth longer than the tube, lanceolate, with subulate setaceous apex; corolla blue; standard obovate, 8 mm. long; stamens 9; pod linear, erect or suberect, 2.5 to 3.5 cm. long, 4 mm. wide, densely rusty-pubescent, 5 to 8-seeded; seeds shortly and subobliquely rectangular, convex, pale brown.

Near Bayamon in the fields at Guinabo; near Caguas; near Yauco in the thicket between the River Duey and Mount Rodadero; near Rincon, about Hacienda Dioplo; near Cabo Rojo, in the plains at Joyuda; near Mayaguez.—Haiti.

Local name, *jicama*.

59. GALACTIA P. Br.

Galactia P. BR. Hist. Jam. 298. 1756.
Odonia BERTOL. Lucubr. Herb. 35. 1822.
Sweetia DC. Prod. **2**: 381. 1825.

Calyx campanulate, the segments long-acuminate, the lowest usually elongate, the lateral ones smaller than the upper one and the lower one; standard ovate or orbicular, subappendiculate or on the edges at the base inflexed; wings long and narrow, obovate, adhering to the keel; keel equaling or exceeding the wings; upper stamen free or connate with the others at the middle; anthers uniform; ovary sessile or substipitate, with numerous ovules; style filiform, with small terminal stigma; pod linear, straight or incurved, flat, very rarely convex on both sides, 2-valved, pulpy or thinly septate between the seeds.—Prostrate or climbing herbs or erect shrubs; leaves pinnate; leaflets 3, rarely 1, 5, or 7, stipellate; bracts small, setaceous, deciduous; flowers small or moderately large, rarely large, red, violet or white, in axillary racemes clustered along the common peduncle in pairs or in fascicles, the lower ones sometimes solitary, seldom without petals; bracts small, setaceous, bracteoles very small.

Professor Urban in Symbolae Antillanae[a] has given a key to all the species of Galactia found in the West Indies and has settled many difficult points. Of this genus only varieties of two different species are found in Porto Rico.

KEY TO THE SPECIES.

Leaflets 2 to 4 cm. long; petals 12 to 15 mm. long; pod 5 to 5.5 mm. wide.	1. *G. dubia.*
Leaflets 2.5 to 6 cm. long; pod 6 to 9 mm. wide.	2. *G. striata.*

1. **Galactia dubia** DC.

(Urban, 304.)

A twining plant, woody below, herbaceous above, clothed densely or thinly with short or very short reflexed and appressed hairs; stipules lanceolate or narrowly lanceolate, often subulate-acuminate, 2 to 3 mm. long; petiole 1 to 4 cm. long; leaflets 3, the terminal one oval, elliptical, or obovate, rounded at the apex, more or less emarginate and shortly apiculate, very obtuse or rotundate at the base, 2 to 4 cm. long, 1.5 to 2 cm. wide, the lateral ones one-third or one-half as long as the terminal one, oval or shortly oval, all chartaceous or chartaceous-coriaceous, glabrous above, shortly and appressedly pilose beneath; inflorescence 1 to 5 cm. long, few-flowered toward the top or at the apex; peduncle 0.5 to 4 cm. long, 0.4 to 0.5 mm. thick; pedicel 3 to 4 mm. long; calyx subglabrous or very laxly and appressedly pilose, 7 to 8 mm. long; corolla rose-colored (ex Duchassaing) or purple (ex Duss); standard obovate or orbicular-obovate, 12 to 15 mm. long, 9 to 10 mm. wide, claw 1 to 1.5 mm. long; wings a little shorter or narrower than the keel, 12 to 14 mm. long, 4 mm. wide; upper stamen free; anthers oblong; ovary subsessile, 12 to 14-ovulate; pod 4 to 5 cm. long, 5 to 5.5 mm. wide, suberect or the upper part more or less incurved, with very short appressed hairs; seeds narrow, ovate-reniform, 3.5 to 5 mm. long, 2 to 3.5 mm. wide, brownish-black, the hilum at or above the middle.

1a. **Galactia dubia ehrenbergii** Urb.

(Urban, 304.)

Stem, calyx, and pod shortly patent-pubescent; leaflets on the upper surface very shortly pilose, on the lower densely pubescent; terminal leaflets obovate or orbicular-obovate, emarginate, the lateral ones shortly oval or subrotundate; calyx teeth often small; standard 11 to 13 mm. long; seeds marmorate, the hilum below the apex; flowers (Sintenis) pale rose-colored or (Stahl) the standard yellow, the wings and keel a bright violet or whitish.

Near Cabeza de San Juan; near Cataño; near Bayamon in the hedges; near Cabo Rojo, in littoral thickets at Joyuda; near Rincon, in the mountains at Barrio Punta.—St. Thomas.

1b. **Galactia dubia guanicensis** Urb.

(Urban, 304.)

Entire stem woody; calyx and pod appressed-pubescent; flowers white; pod 3 to 4 cm. long. The rest as in *ehrenbergii*.

Near Guanica in thickets on Mount El Maniel.

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[a] **2**: 318. 1900.

2. **Galactia striata** (Jacq.) Urb.

(Urban, 304.)

Perennial twining, stem becoming woody at the base, elongate, clothed with moderately long or short, white, more or less spreading hairs; stipules subulate, 2 to 4 mm. long; peduncle 1.5 to 3.5 cm. long; leaflets 3, terminal one ovate-elliptical, very obtuse or subrotundate at the apex with a minute mucro, more acutate, obtuse or subobtuse at the base, 3.5 to 6 cm. long, 2 to 3 cm. wide, the lateral ones a little or one-third shorter than the terminal, suboblique, ovate, rounded at the base, rotundate or very obtuse at the apex, all membranous, with short appressed hairs above, pubescent beneath; inflorescence 3 to 15 cm. long, peduncle 0.6 to 1 mm. long, many-flowered above; pedicels 2 to 2.5 mm. long; calyx densely pubescent, its hairs appressed, 7 mm. long, anterior teeth lanceolate, acuminate, 2½ times as long as the tube, the lateral ones lanceolate, acutate, twice as long as the tube, posterior ovate-lanceolate, obtuse; standard purple, striate, 8 to 9 mm. long, 5 mm. wide, broadly obovate, the claw 1 mm. long; keel almost without color, dorsally arcuate, as long as the standard, wings purple, a little narrower and much shorter than the keel, 8 mm. long, 1.5 mm. wide; upper stamen free, all above incurved; anthers ovate or ovate-oblong; ovary sessile, about 11-ovulate; legume (ex Jacquin) sometimes erect, sometimes a little incurved; seeds reniform, brown, variegated.

2a. **Galactia striata tomentosa** (Bertol.) Urb.

(Urban, 305.)

Stem clothed with moderately long, sometimes subequal white hairs, sometimes recurved-pubescent; leaflets ovate, rarely orbicular-ovate or elliptical, rounded at both ends, rarely obtuse, above shortly pilose, beneath densely soft-tomentose; calyx densely patent-pubescent, 7 to 8 mm. long; corolla rose-colored, the outside green or rose-colored or peach-colored; standard 9 to 10 mm. long, 5 to 6 mm. wide, obovate; wings much shorter than the keel, 8 mm. long, 1.5 to 1.8 mm. wide; pod 4 to 7 cm. long, 7 to 9 mm. wide.

At St. Isabel; near Maunabo, in thickets at Punta de la Tuna and at Punta Mala Pasqua; near Aibonito, at Algarrobo; between Aibonito and Coamo along roads and on rocks; near Coamo, at Pedro Garcia and in the valley of the El Tendal River; near Juana Diaz at Escalabrado; near Cabo Rojo, in thickets at Monte Grande and in the woods on the coast.—Haiti, St. Thomas, St. Croix.

2b. **Galactia striata berteriana** (DC.) Urb.

(Urban, 305.)

Stem clothed with short subretrorse or horizontal hairs; leaflets glabrous or slightly pilose above, clothed beneath with short appressed hairs, narrowed at both ends, the apex obtuse or acutate; flowers red or rose-colored; standard 9 to 10 mm. long; wings a little shorter than the keel, much shorter than the standard, 8 mm. long; seeds 9 to 14.

Near Bayamon on hedges; near Fajardo in the mountain forests; near Barranquitas in copses near the River Isabon; near Cabo Rojo, on Monte Grande; near Rincon, at Barrio del Pueblo and in coast districts; near Aguadilla, at Barrio Victoria.—Guadeloupe (?).

60. DIOCLEA H. B. K.

Dioclea H. B. K. Nov. Gen. & Sp. **6:** 437. *pl. 576.* 1823.
Hymenospron SPRENG. Syst. **4:** Cur. Post. 282. 1827.
Crepidotropis WALP. Linnaea **14:** 296. 1840.

Calyx oblique, obconical, with the two upper teeth connate, the lateral ones small, the lowest longer; standard orbicular, reflexed, the base with a pair of inflexed auricles; wings obovate or oblong, free, as long as or rather shorter than the keel; keel incurved, obtuse or rostrate; upper stamen free at the base, connate with the others at the middle; anthers uniform or the 5 alternate ones very small and abortive; ovary subsessile, 2 to many-ovulate; style incurved, dilated or thickened upwards; stigma oblique, truncate; pod oblong, linear, semiorbicular, or somewhat reniform, compressed or somewhat turgid, coriaceous, both sutures narrowly winged or the upper dilated and incrassate, the lower not altered, 2-valved, septate between the seeds; seeds orbicular or somewhat reniform, with a short or long, linear, more or less thickened or somewhat fleshy hilum.—Twining shrubs or undershrubs; leaves pinnate; leaflets 3, stipellate; stipules small, sometimes spurred, sometimes glandular; flowers blue; violet, or white, in terminal usually elongated racemes, fascicled along the rachis; bracts caducous; bracteoles membranous, persistent.

A moderately small genus, almost entirely tropical American.

1. **Dioclea reflexa** Hook. f.

(Urban, 305.)

Stem woody, climbing to a height of 6 meters, terete, clothed with long, spreading, fine, deciduous yellowish gray hairs; stipules 1 to 1.8 cm. long, scariose, peltate; petioles 5 to 7.5 cm. long; terminal leaflet obovate-oblong, 10 to 15 cm. long, the base rounded, the apex cuspidate, the lateral leaflets similar, subcoriaceous, the upper surface glabrous, lower thinly and deciduously silky; flowers in moderately dense racemes, 10 to 15 cm. long, on firm peduncles often as long; calyx dark brown, 9 mm. deep; corolla dark red or bordering on purple; standard with a yellow spot at the base; pod oval or oval-oblong, 9 to 13 cm. long, 5 to 6 cm. wide; seeds 1 to 3, oblique, ovate-orbiculate, 2.5 to 3.0 cm. long, 2.2 to 2.6 cm. broad, of a bright or a dark wine color, the older ones becoming brownish.

In primeval forests near Yabucoa, on Mount Guayava, and near Maunabo, at La Pandura; in Sierra de Luquillo between Mavi and Mount Jimenez.—Cuba, Jamaica, Dominica, St. Vincent, Grenada, Tobago. A plant of tropical Asia, Africa, America, and New Guinea.

Local names, *mato* or *bejuco de mato;* Cuba, *ojo de buey de costa.*

61. CANAVALIA DC.

Canavali ADANS. Fam. **2:** 325, 531. 1763.
Canavalia DC. Mem. Legum. 375. 1825.

Calyx bilabiate, the upper lip large, truncate or bifid, the lower one much smaller, entire or trifid; standard reflexed, large, suborbicular or broadly obovate, with or without auricles at the base; wings narrow, falcate or twisted, free; keel incurved, broader than the wings, obtuse or rostrate; upper stamen free below, more or less connate at the center; ovary sessile or very shortly stipitate, multiovulate; style incurved; stigma terminal, small, capitate; pod oblong, or broadly linear, compressed or subturgid, with a prominent longitudinal wing or rib on each side of the upper suture, 2-valved, slightly septate between the seeds; seeds large, rounded or oblong, compressed.—Large herbs with twining or trailing stems; leaves pinnate; leaflets 3, stipellate; stipules small, often gland-like or none; flowers usually large, purplish, pink, or white, in axillary racemes; pedicels very short, clustered on lateral nodes along the upper portion of the rachis; bracts minute; bracteoles small, orbicular, very deciduous.

KEY TO THE SPECIES.

Leaflets obovate or orbiculate, very obtuse or retuse, membranous or subpapyraceous; pod oblong, 5 to 13 cm. long, 2 to 3 cm. wide; seeds 6 to 8, chestnut-brown with a black spot, opaque, ovoid, 1.5 cm. long, 1 cm. wide.	1. *C. obtusifolia.*
Leaflets chartaceous or chartaceous-coriaceous, ovate or narrowly ovate, very shortly and acutely acuminate; pod oblong-linear, 12 to 25 cm. long; seeds ovate-rotundate, 18 to 24 mm. long, 15 to 20 mm. wide, wine-colored, 4 to 6-seeded.	2. *C. rusiosperma*

1. **Canavalia obtusifolia** (Lam.) DC.

(Urban, 306.)

Stem biennial, climbing or sometimes prostrate; petiole 5 to 7.5 cm. long; leaflets 7.5 to 10 cm. long, 5 to 6 cm. wide; flowers in 16 down to 12-flowered racemes on long flexuose peduncles; pedicels stout, 4 to 6 mm. long, springing from fleshy tubercles; calyx broad-campanulate, 1.2 cm. deep, the upper lip rounded, bifid, glabrous; corolla reddish-purple, fragrant; standard 1.8 to 2.5 cm. long; pod with two prominent ribs a little distant from the upper suture.

In coast districts near Yabucoa; in thickets at Puerto de la Vaca; near Patillas, at Guardaraya; near Guanica, at Salinas; near Mayaguez.—South Florida (Chapman), Bermuda (Hemsley), Bahama, Cuba, Jamaica, Cayman, Haiti, St. Thomas, St. Croix, St. John (Eggers), Antigua (Grisebach), Sandy Island, Guadeloupe, Dominica (Grisebach), Martinique, St. Vincent, Bequia (Kew Bull. No. 81, p. 246), Grenada, Tobago, Trinidad (Grisebach). Widely dispersed through the tropics of both hemispheres and often cultivated. *C. obtusifolia* is a characteristic plant of sandy seashores, where it often creeps among stones. According to Balfour it "is a useful binder of loose sand."

The ovate leaves, the long pod, and the large wine-colored seeds of C. *rusiosperma* make it easy to distinguish from *C. obtusifolia*, which has obovate or orbicular leaves, a shorter pod, and chestnut-brown seeds.

Local name, *mato de la playa.*

2. **Canavalia rusiosperma** Urb.

(Urban, 305.)

Stem twining, reaching 10 cm. in thickness, climbing on high trees; petiole 3.5 to 8 cm. long; leaflets 6.5 to 10 cm. long, 4 to 5.5 cm. wide; inflorescence 5 to 25 cm. long; calyx 11 mm. long, upper lobes 6 to 7 mm., lower ones 1 to 2 mm. long, thinly pilose or glabrous; petals red (Stahl) or violet (Eggers); standard 2 to 2.3 cm. long; pod 12 to 25 cm. long, 4 to 5 cm. wide with two prominent ribs a little distant from the upper sutures.

In the primeval forests near Maricao, on Mount Montoso; near Lares at Callejones; near Quebradillas.—Haiti, St. Thomas.

Local name, *mato colorado.*

62. **CAJANUS** DC.

Cajan ADANS. Fam. 2: 326, 529. 1763.
Cajanus DC. Cat. Hort. Monsp. 85. 1813.
Cajanum RAF. Sylva Tellur. 25. 1838.

Calyx campanulate, with the two upper teeth connate, the others equal; standard orbicular, reflexed, the base appendiculate with inflexed auricles; wings obliquely obovate; keel with an incurved apex, truncate; upper stamen free, the others connate; anthers uniform; ovary subsessile, multiovulate; style incrassate above the middle, beardless, slightly dilated below the obliquely terminal stigma; pod linear, obliquely acute, compressed, 2-valved, with transverse constrictions between the seeds on the outside, scarcely septate within; seeds subglobose, slightly compressed.—Erect undershrubs; leaves pinnate; leaflets 3; stipules subulate, caducous; flowers yellow, usually veined with purple, in axillary pedunculate racemes; bracts deciduous.

1. **Cajanus indicus** Spreng.[a]

(Urban, 306.)

Undershrub 2.5 to 3 meters high, erect; branches angular, finely gray-silky with adpressed hairs; petioles 1 to 4 cm. long; leaflets oblong or oblong-lanceolate, 4 to 10 cm. long, acute, subcoriaceous, the upper surface glabrous, the lower gray-silvery; flowers in 2 to 8-flowered axillary racemes, yellow or sometimes the standard spotted with orange; pedicels 0.6 to 1.5 cm. long; calyx silky, 6.5 to 8.5 mm. deep, the teeth lanceolate, not reaching halfway down; corolla 1.5 to 1.8 cm. deep; pod 5 to 8 cm. long, 0.9 to 1.5 cm. broad, 3 to 5-seeded, finely pubescent.

Cultivated and seemingly spontaneous near Bayamon; near Lares; at Perchas and at Espino; near Maricao on the declivities of Mount Montoso; near Mayaguez, in coast districts at Algarrobo.—Bermuda (Hemsley), Bahama, Cuba (Grisebach), Jamaica, Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Martin (Stockholm Herbarium), St. Bartholomew (do.), St. Kitts (Grisebach), Antigua (do.), Guadeloupe, Martinique, St. Vincent, Barbados, Grenada, Trinidad (Grisebach), Margarita. Cultivated throughout the Tropics; probably indigenous in Africa.

The seeds taste like a coarse description of field peas and are sold either in the form of split peas or of flour in India, where they are highly esteemed by the natives. The young pods are used for salad. The roots, leaves, and flowers are employed as a medicament. The leaves are considered excellent as a fodder for cattle.

Local names, *gandul*, *gandures*.

63. **RHYNCHOSIA** Lour.

Dolicholus Medic. Vorles. Churpf. Phys. Ges. **2**: 354. 1787.
Rhynchosia Lour. Fl. Cochinch. **2**: 460. 1790.
Rynchosia Macfad. Fl. Jam. **1**: 275. 1837.

Calyx campanulate or tubuliform-campanulate, the 2 upper lobes more or less connate; standard orbicular or obovate, usually with inflexed auricles at the base; wings narrow; keel incurved at the apex; upper stamen free; ovary sessile or nearly so, with 2 or very rarely 1 ovule; style incurved upward, filiform or incrassated; stigma small terminal, capitate; pod oblique, orbicular, oblong, or slightly curved, compressed, 2-valved, continuous or rarely septate internally; seeds 2, rarely ovoid or almost reniform, compressed, with a lateral short or oblong hilum, the funicle centrally attached-with or without a strophiole.—Twining or trailing, rarely erect herbs or undershrubs; leaves pinnate; leaflets 3, seldom only 1, without stipels; stipules ovate, subulate persistent or caducous; flowers yellow, the standard often streaked with brown or purple, more rarely purple, white, or greenish; peduncle axillary, bearing a raceme or rarely single flowers; bracts deciduous

KEY TO THE SPECIES.

Calyx segments lanceolate, several times longer than the very short tube, and as long as or longer than the standard. (Section Arcyphyllum Ell, as genus.)
  Legume pubescent or glabrescent, not constricted, 2.2 to 6.6 mm. long; seeds nearly black, reniform-roundish, compressed, about 4 mm. in diameter. 1. *R. reticulata*.

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[a] Cook and Collins, p. 100, as *Cajanus cajan*.

Calyx-tube obtuse at the base; the calyx segments long or short, always shorter than the standard. (Section COPISMA.)

Pod constricted between the seeds, tomentose or glabrescent, 2 to 2.5 cm. long, 8 mm. broad; seeds two-colored, black with a scarlet-yellow ring round the hilum; flowers in many-flowered racemes (10 to 20 cm. long); terminal leaflet 7 to 10 cm. long; leaves beneath and calyx with scattered, very small yellowish glands. 2. *R. phaseoloides.*

Pod continuous, oblong, tapering at the base, pubescent, soon glabrous, 1.3 to 1.75 cm. long, 4 to 5 mm. wide; seeds black; flowers in lax 6 to 12-flowered racemes (5 to 7.5 cm. long); terminal leaflet 1.8 to 2.5 cm. long; leaves beneath and calyx with large brownish glands. 3. *R. minima.*

1. **Rhynchosia reticulata** (Sw.) DC.

(Urban, 307.)

Stem suffrutescent, twining, from 23 to 90 cm. high, angular, tomentose; leaflets ovate, acute or acuminate, 5 to 7.5 cm. long, 2.25 to 4 cm. wide, 3-nerved and reticulated beneath, with the ribs prominulous, tomentose, or villose on both sides; racemes many-flowered, from 5 to 15 cm. long, axillary; calyx 6.5 to 13 mm. deep, tube very short; corolla yellow or variegated with purple.

Near Bayamon, in littoral thickets; near Cayey, on Morillos brook; near Coamo, in the valley of the El Tendal River; near Maricao, on the edges of the woods; near Guanica, in the thickets of Mount El Maniel; near Cabo Rojo, in copse land; near Mayaguez; near Pepino, on declivities at Eneas.—Cuba, Jamaica, Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Martin (Stockholm Herbarium), St. Bartholomew, St. Kitts, Antigua (Grisebach), Guadeloupe, St. Vineent. Widely distributed in the warmer parts of America.

Rhynchosia reticulata differs from the other two Rhynchosia species found in Porto Rico in having calyx segments that are much longer than the tube, and as long as or longer than the standard.

2. **Rhynchosia phaseoloides** (Sw.) DC.[a]

(Urban, 307.)

Stem woody at the base, branches herbaceous, a high climbing plant; leaflets ovate or ovate-rhomboid, acuminate, 5 to 9 cm. long, 3.5 to 5 cm. wide, very variable in the down and in the size and form of the leaflets; racemes many-flowered, 8 to 13 cm., sometimes 20 cm. long; flowers yellow with many red-brown lines; calyx 2 mm. long, tomentose; corolla 11 to 15 mm. long; standard striate with purple.

Near Bayamon; near Aibonito, in the primeval forests at Cuyon and at Barrio del Pasto; near Utuado, on shady declivities at Pellejas and in rocky localities of the primeval forest at Los Angeles; near Lares, in mountain forests at Callejones; near Camuy, on the edge of the woods at Cacao; near Manati, on calcareous mountains at Rio Arriba Saliente; near Barceloneta, on the edges of the forests of Mount Florida.—Cuba, Jamaica (variety), Haiti, St. Thomas (Eggers), Guadeloupe (variety), Dominica (Grisebach), Martinique (Copenhagen Herbarium), St. Vincent (variety), Trinidad (Grisebach).—Central America, South America.

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[a] Cook and Collins, p. 136, as *Dolicholus phaseoloides*.

The differences in the pod and seeds of *R. phaseoloides* and *R. minima* are quite striking. The pod of the former is constricted between the seeds, and the seeds are black with a scarlet-yellow ring around the hilum, while the pod of the latter is not constricted between the seeds, is much smaller, and has seeds that are entirely black. The large brown glands on the under side of the leaves and on the calyx of *R. minima* are most noticeable.

Local names, *bejuco de paloma*, *peronias*.

3. **Rhynchosia minima** (L.) DC.[a]

(Urban, 307.)

Stems firm, herbaceous, slender, trailing or twining, minutely tomentose or nearly glabrous; leaflets broadly ovate-rhomboidal, mostly about 2.5 cm. long when full grown, but often much smaller; stipules minute, setaceous; racemes bearing in their upper portion scattered pendulous yellow flowers, rarely exceeding 6.5 mm. in length, on very short pedicels; calyx 4.5 mm. long, subglabrous; teeth linear-setaceous, reaching more than halfway down; corolla 18 mm. deep; standard nòt silky, yellow veined with purple.

Near Bayamon; near Cataño; near Coamo, in the valley of El Tendal River; near Lares, in thickets at Los Angeles; near Guanica, between Boca and Barinas in ditches; near Cabo Rojo, at Miradero; near Mayaguez, in coast districts at Algarrobo; near Rincon, at Calvache.—One of the Florida Keys (Chapman), Bahama, Cuba, Jamaica, Cayman, Haiti, St. Thomas, St. Croix, St. John (Eggers), St. Bartholomew (Stockholm Herbarium), Guadeloupe, Martinique, St. Vincent, Bequia (Kew Bull. no. 81, p. 247), Mustique (do.), Union, Barbados, Grenada, Trinidad (Grisebach), Margarita. This species appears to be abundant in almost all subtropical or tropical countries. A common weed (ex Grisebach).

Local name, *frijolillo*, *pequeño*.

64. PHASEOLUS L.

Phaseolus L. Sp. Pl. **2**: 723. 1753.

Calyx campanulate or shortly tubuliform, the 2 upper teeth free or connate, the others deltoid or lanceolate; standard orbicular recurved or subtortuous, more or less distinctly auriculate at the base, the edges inflexed toward the base, with or without a longitudinal callus in the middle; wings obovate or rarely oblong, equaling or exceeding the standard, adhering to the keel above the claw, often twisted; keel linear or obovate, with a long obtuse spirally twisted beak; upper stamen free, often incrassated or appendiculate above the base, the rest connate; ovary subsessile, with a cupuliform discus, multiovulate; style long, incrassated within the beak of the keel and twisted with it, usually longitudinally bearded upward; stigma oblique or on the inner side of the style; pod linear or oblong, terete or compressed, straight or falcate, 2-valved, usually slightly septate between the seeds.—Herbs, either annual or perennial and woody at the base, short and erect or elongated and twining in the same species; leaves pinnate; leaflets 3 or very rarely 1, with stipules; stipules persistent, striate, often calcarate; flowers white, yellow, violet, red, or purple, in axillary racemes; bracts usually deciduous; bracteoles often wide and for some time persistent.

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[a] Cook and Collins, p. 136, as *Dolicholus minimus*.

KEY TO THE SPECIES.

- Stipules not peltate; stipules and bracteoles ovate or oblong; wings a little longer than the standard; upper tooth of the calyx short, broad, truncate, emarginate. (Section EUPHASEOLUS.)
  - Calyx teeth all shorter than the tube.
    - Legume flat, broad, falcate, 2 or 3-seeded. 1. *P. lunatus.*
    - Legume linear, many-seeded, straight or slightly arcuate.
      - Bracteoles broad, equal to the calyx; peduncle shorter than the petiole. 2. *P. vulgaris.*
      - Bracteoles narrow, shorter than the calyx, peduncle usually longer than the petiole.
        - Keel spirally twisted (3 or 4 times). 3. *P. caracalla.*
        - Keel slightly twisted. 4. *P. antillanus.*
  - The lowest calyx teeth narrow, subequal to or longer than the tube. 5. *P. adenanthus.*
- Stipules often more or less peltate below the insertion; upper tooth of the calyx short, broad, truncate or emarginate; wings subequal to the standard. (Section STROPHOSTYLES.) 6. *P. ovatus.*
- Stipules not peltate; calyx subtubular, with 5 acute teeth; wings long-clawed, longer than the standard; legume narrow, reflexed. (Section MACROPTILIUM.) 7. *P. lathyroides.*

1. **Phaseolus lunatus** L.

(Urban, 308.)

Stems biennial, usually twining; leaflets 3, the central one ovate-deltoid, 7 to 10 cm. long, 5 to 7 cm. broad, the lateral ones very unequal-sided; flowers in copious long or short stalked axillary racemes 2.5 to 10 cm. long; calyx 2.2 to 3 mm. deep; corolla under 1.5 cm. deep; standard dull green, wings and keel pale blue or in the cultivated plant white; pod 5 to 7.5 cm. long, 1.25 to 1.17 cm. wide, glabrous, the upper suture slightly and the lower much recurved, dark violet, margins green; seeds purple or white.

Spontaneous and cultivated, near Coamo, in thickets at Farajones and in woods at Pedro Garcia; near Cabo Rojo, on hedges at Buena Vista; near Rincon, in thickets at Puntas; near Aguadilla in gardens at Espinel.—Cuba, Jamaica (Grisebach), Haiti, St. Thomas (Eggers), St. Croix (do.), St. John (do.), Antigua (Grisebach), Guadeloupe, Dominica, Martinique, St. Vincent, Barbados, Trinidad (Kuntze), Margarita. Tropical America. Widely dispersed through the tropics of both hemispheres.

P. lunatus is easily distinguished from *P. vulgaris* by its racemose inflorescence and its smaller flowers, pods, and bracts.

This plant is cultivated in Africa for the same purpose as *P. vulgaris* with us.

Local name, *habas*. Lima bean.

2. **Phaseolus vulgaris** L.

(Urban, 308.)

Stem annual, wide-climbing; leaflets 3, the central one broad-ovate, 10 to 12.5 cm. long, acute; peduncles in pairs, 2.5 to 5 cm. long, 2 or 3-flowered; pedicels 4.5 to 8.5 mm. long; calyx 0.6 mm. deep; corolla white or lilac, 2.5 cm. long; pod 10 to 12.5 cm. long, 1.2 cm. wide.

Cultivated near Adjuntas at Junco and near Mayaguez. *P. vulgaris* is a commonly cultivated species, not clearly known anywhere in a native state.

The home of the common bean, *P. vulgaris*, as Wittmack has shown, is South America, where nearly related species are also cultivated. Of this species there are innumerable varieties. The green pods are used as a vegetable in the form of "string" or "snap" beans. The mature seeds, of which there are a number of different colors, are, on account of the abundance of legumin and starch, very nutritious, but also somewhat difficult to digest. They are consumed in large quantities, cooked in various ways, in Mexico, the United States, and Europe. A small white variety, the "navy bean," is used for victualing ships. The meal made from the seeds was formerly and is even yet used for poultices and is a component part of rouge.

Local name, *habichuela*.

3. **Phaseolus caracalla** L.

(Urban, 308.)

Stems woody at the base, high-twining, glabrous or subpubescent; stipules ovate or oblong; petiole often reaching 1 foot in length; leaflets usually 30 cm. long, 10 cm. wide, membranaceous; peduncle about 30 cm. long; nodes thickened, pedicels about 1.2 cm. long; flowers about 2.5 cm. long, fragrant, purplish-lilac, or yellow and orange mixed; calyx about 1 cm. long, large, often colored, glabrous; lobes short, broad, very obtuse, uppermost one bifid, all much shorter than the tube; petals all more or less twisted, keel 3 or 4 times twisted; legume straight, pendulous, 15 cm. long, acuminate, glabrous, torulose.

Cultivated near Mayaguez.—Native country, South America.

Local name, *caracol*.

4. **Phaseolus antillanus** Urb.

(Urban, 309.)

Stems twining, 7 meters long; stipules oblong or obliquely ovate-oblong, 3 to 4 mm. long, the apex obtuse; petiole with narrow and obliquely ovate stipels, reaching 2 mm. in length; leaflets 3, the central one triangular or ovate-oblong, shortly acuminate, 5 to 7 cm. long, 3 to 5 cm. wide with a petiolule 1 to 2 cm. long, the lateral ones very unequal-sided, obliquely ovate, truncate at the base, with a petiolule 2 to 3 mm. long, all membranaceous when dry, shortly and thinly pilose or subglabrous; peduncle 7 to 30 cm. long, with 2 to 5 nodes above; bracts, ovate-oblong obtuse, 2 to 4 mm. long; pedicel 1 to 2 mm. long; calyx 5 to 6 mm. long, glabrous or above thinly pilose, shortly ciliate on the margin; tube campanulate; lower segments triangular or ovate, obtuse, half as long as the tube, the lateral one somewhat longer, the uppermost one broadly truncate or slightly emarginate; flowers blue, 20 to 25 mm. long, with a pedicel 1 to 2 mm. long; standard broadly ovate, 20 mm. long, 17 mm. wide below, the apex rotundate, slightly emarginate, the claw 5 mm. long; wings obovate-oblong, the apex subtruncate, 18 to 25 mm. long; pod 8 to 13 cm. long, 4 to 5 mm. wide, thinly clothed with minute hairs, margin incrassate; seeds ovate-reniform, 3.5 to 4 mm. long, 2.5 mm. wide, convex, brown, often spotted with white.

Between Aibonito and Algarrobo on roadsides; near Juana Diaz in thickets toward Escalabrado; near Guanica, in shady plains at Montalba; near Añasco on declivities at Hatillo.—Cuba (Wright), Jamaica (March), Haiti (Buch), Martinique (Duss), St. Vincent (Smith).

Probably near *P. peduncularis* H. B. K., as well as can be determined from the very incomplete type specimen of that species.

5. **Phaseolus adenanthus** G. F. W. Mey.

(Urban, 308.)

Stem firm-herbaceous, wide-climbing; stipules 4.4 mm. deep, broad, ovate, erect, persistent; petiole 3 to 6 cm. long; leaflets 3, the central one ovate, acuminate, 5 to 10 cm. long, 2 to 3.5 cm. wide, the lateral ones unequal-sided, the veins beneath slightly rufo-pubescent; flowers 6 to 12 in moderately dense axillary racemes on peduncles exceeding the leaves, white with large red spots; calyx 0.6 mm. deep; corolla

2.2 cm. deep, rose-red, rarely yellow and violet; pod 10 to 12.5 cm. long, 6 to 8 mm. wide, linear, compressed, slightly pubescent, dark; seeds 12 to 15.

Near Bayamon on the roadside and in hedges; near Cabo Rojo, in thickets toward Monte Grande; cultivated near Mayaguez; near Añasco, in thickets at Hatillo; near Aguadilla, at Victoria.—Jamaica (Grisebach), Haiti, Guadeloupe, Martinique, St. Vincent, Tobago. Cosmopolitan in the tropics.

This plant is in its habit quite different from *P. semierectus*. *P. adenanthus* is wide climbing, the other erect, twining above. The pod of *P. semierectus* is very narrow and subcylindrical, that of *P. adenanthus* widely linear and compressed. The flowers are larger than those of any other Porto Rican Phaseolus. In India the tuberous root is cooked and eaten, especially in time of famine.

Local name, *habichuela cimarrona* (Cook and Collins).

6. **Phaseolus ovatus** Benth.

(Urban, 309.)

Stem climbing, slender, clothed with red-brown hairs; leaflets ovate or ovate-lanceolate, obtuse, 5 to 7.5 cm. long, membranous, beneath or on both sides pilose, becoming glabrous; stipules ovate or oblong, about 6 mm. long, auriculate or subpeltate at the base; peduncle 7.5 to 12.5 cm. long; bracts linear, subulate, pilose, caducous; calyx subsessile, 2 to 4 mm. long, glabrous, the teeth shorter than the tube, the upper one broad, the lateral ones obtuse, lowest one subacute; flowers yellow; standard orbicular, 1.2 to 1.4 mm. long; wings obovate, a little longer than the standard; beak of the keel spirally twisted; legume 2.5 to 3.5 cm. long, 6 mm. wide, compressed, later subterete; seeds ovate, compressed.

Near Mayaguez and near Vega Baja on the margins of the Yeguana Lake.—Cuba, Brazil, Uruguay.

7. **Phaseolus lathyroides** L.[a]

(Urban, 310.)

Stem erect or twining above, sericeous or glabrescent; leaflets broadly ovate or sublanceolate; 2.5 to 5 cm. long, 1 to 2 cm. wide; stipules lanceolate, setaceo-acuminate, striate, 4 to 6.5 mm. long; petiole 2 to 3.5 cm. long; peduncle elongated, 15 to 30 cm. long, flowering part 5 to 7.5 cm. long; calyx 6 mm. deep; corolla purple, 1.3 to 1.7 cm. deep; pod narrowly linear, erect, subcylindrical, 7 to 11 cm. long, 4 mm. wide, many-seeded.

Near Bayamon in rocky and dry places; near Aibonito, at La Lima; in Maricao in the streets; near Mayaguez.—Bahama, Cuba, Jamaica, Cayman, Haiti, St. Thomas, St. Croix (Eggers), St. John (do.), Antigua, Guadeloupe, Martinique, St. Vincent, Bequia, Mustique (Kew Bull. no. 81, p. 247), Barbados, Grenada, Curaçao. Indigenous in tropical America; distributed over the tropics of the whole world.

Sintenis collected under the no. 5854 and under the name *habichuelas* a cultivated species of Phaseolus, which can not be determined because its flowers are faded and deformed. Is this not perhaps *P. multiflorus* Willd.?

65. **VIGNA** Savi.

Vigna Savi, Osserv. Phas. 3: 7. 1824.
Callicysthus Endl. Prod. Fl. Norfolk 90. 1833.
Scytalis E. Mey. Comm. Pl. Afr. Austr. 144. 1835.

Calyx campanulate or subtubuliform, the two upper lobes free or connate; standard suborbicular, the base appendiculate, with inflexed auricles; wings falcate-obovate, rather shorter than the standard; keel almost as long as the wings, truncate, or beaked at the tip, but the point not spiral; upper stamens free, the others united; ovary sessile, multiovulate; style filiform, dilated upwards, longitudinally bearded on the inner side upwards; stigma very oblique; pod linear, straight or slightly recurved, subterete, 2-valved, filled within between the seeds; seeds reniform, quadrate.—Herbs, either prostrate and trailing or twining or more rarely somewhat erect; leaves pinnate; leaflets 3, stipellate; stipules usually persistent, rarely produced below their insertion; flowers greenish yellow, more rarely purple, in axillary racemes; bracts and bracteoles usually very deciduous.

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[a] Cook and Collins, p. 216, as *Phaseolus semierectus*.

KEY TO THE SPECIES.

Calyx teeth linear-lanceolate, equaling the tube; stem and leaflets clothed with adpressed, strong, silky hairs; terminal leaflet lanceolate or ovate-lanceolate; peduncles 7.5 to 30 cm. long, 2 to 4-flowered; corolla reddish-purple, 2.5 cm. long, conspicuously veined; keel prolonged into an incurved beak; pod linear, 7.5 to 10 cm. long, silky, recurved. 1. *V. vexillata.*

Calyx teeth deltoid, shorter than the tube.

- Pod 3.7 to 5 cm. long, 6 mm. broad, slightly recurved, glabrescent or thinly silky, 8 to 10-seeded; seeds shiny, brown with white hilum; terminal leaflet ovate, acute, 5 to 7.5 cm. long, both sides glabrous; stipules not spurred; flowers 12 to 20 in a conical raceme on a glabrous peduncle 5 to 10 cm. long; corolla pale yellow, 11 to 13 mm. long. 2. *V. repens.*
- Pod pendulous, 15 to 30 cm. long, 9 mm. broad, subcompressed, 10 to 15-seeded, slightly torulose when fully matured; seeds white, red, or black; terminal leaflet roundish or ovate, 7.5 to 15 cm. long, both sides glabrous; stipules comparatively large, distinctly spurred; flowers in 6 to 12-flowered racemes, on glabrous peduncles 15 to 30 cm. long; corolla yellow or reddish, 2.5 cm. deep. 3. *V. unguiculata.*

1. **Vigna vexillata** (L.) A. Rich.

(Urban, 310.)

Stem herbaceous, wide climbing; terminal leaflet 5 to 7.5 cm. long; petiolule 1 to 1.8 cm. long, flowers white inside, becoming blue; calyx 1 to 1.5 cm. deep.

Near Bayamon in meadows and on roadsides; between Aguas Buenas and Caguas on roadsides.—Cuba, Haiti, St. Vincent, Grenada. This species is widely spread over tropical Asia, Africa, and America.

This plant on account of the obliquity of the flower and the length of the beak is intermediate in some respects between Vigna and Phaseolus, and has been placed alternately by botanists in either of these genera or in Dolichos, or it has been proposed as a distinct genus.

Local name, *frijol cimarrón.*

2. **Vigna repens** (L.) O. Kuntze.[a]

(Urban, 311.)

Stems very slender, wide-twining, glabrous; petiole 2.5 to 5 cm. long; stipules minute, lanceolate, not spurred; leaflets 3, membranous, both sides glabrous, the end one ovate, acute, 5 to 7.5 cm. long; petiolule 0.8 to 1.6 cm. long; lateral ones unequal-sided; flowers up to 12 or 20 in a conical raceme on a glabrous peduncle 5 to 10 cm.

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[a] Cook and Collins, p. 262, as *Vigna luteola.*

long, yellow; pedicel 2 mm. long; bracts and bracteoles very minute; calyx campanulate, glabrous, 4 mm. deep; teeth deltoid, shorter than the tube; corolla 1 to 1.2 cm. long; standard glabrous on the back; pod 3.7 to 5 cm. long, slightly recurved, glabrescent or thinly silky.

Near Bayamon in grassy plains; near Patillas in coast districts at Guardaraya; near Sabana Grande, on the bank of Estero River; near Salinas de Cabo Rojo at Los Morillos; near Mayaguez; in coast districts at Algarrobo; near Manati in meadows near the seashore.—Bermuda (Hemsley), Cuba, Jamaica, Cayman (Hitchcock), Haiti, St. Thomas, St. Croix, St. John (Eggers), Antigua (Grisebach), Guadeloupe, St. Vincent, Bequia (Kew Bull. No. 81, p. 247), Barbados, Grenada, Tobago. This species is common from temperate North America to Argentina. Tropical and south Africa, tropical Asia, and Australia.

3. **Vigna unguiculata** (L.) Walp.

(Urban, 311.)

Stems annual, twining, subglabrous; stipules ovate-lanceolate, subpeltate, 0.8 to 1.2 cm. deep; petioles 5 to 15 cm. long, glabrous; leaflets 3, the central one roundish or ovate, 7.5 to 15 cm. long, acute, the base rounded; petiolule 2.5 to 5 cm. long, lateral ones often unequal-sided, both sides glabrous; flowers in 6 to 12-flowered racemes on glabrous peduncles 15 to 30 cm. long; bracts like the stipules; pedicels very short; calyx glabrous, 4 mm. deep; teeth deltoid, acuminate, shorter than the tube, the two upper ones connate; corolla yellow or reddish, 2.5 cm. deep.

Cultivated near Yabucoa, at Guayavote, and near Mayaguez. Universally cultivated throughout the Tropics.

Two varieties occur, one with lilac flowers and yellow seeds spotted with red, the other with yellow standard, purplish white wings, and white or pale yellow seeds which are brown at the hilum.

The pods and seeds are eaten and the fibers of the long peduncles are used for ropes, nets, and cloths.

Local names, *frijoles*, *lentejas*.

66. **PACHYRHIZUS** Rich.

Cacara RUMPH.; Thou. Dict. Sc. Nat. **6**: 35. 1806.
Pachyrhizus RICH.; DC. Mem. Legum. 379. 1825.
Taeniocarpum DESV. Ann. Sc. Nat. **9**: 420. 1826.

Calyx campanulate, the two upper teeth subconnate, the others equal, lanceolate; standard broadly obovate, appendiculate at the base with inflexed auricles; wings oblong, falcate; keel incurved, obtuse, equaling the wings; stamens diadelphous or monadelphous; ovary subsessile, multiovulate; style moderately thick, the apex subinvolute, flattened on the inner side; stigma subglobose, oblique; pod linear, subcompressed, depressed transversely between the seeds and septate within, 2-valved.—Herbs, twining; leaves pinnate; leaflets 3, usually more or less sinuate-dentate, stipellate; flowers in elongated, sometimes panicled axillary racemes; bracts and bracteoles minute, setaceous, deciduous.

KEY TO THE SPECIES.

Root a turnip-like tuber; corolla blue; pod 15 to 22.5 cm. long.	*P. erosus.*
Root of long cord-like fibers bearing a succession of tubers; flowers white; pod 20 to 30 cm. long.	*P. tuberosus.*

1. **Pachyrhizus erosus** (L.) Urb.[a]

(Urban, 311.)

Root a tuber like a turnip; stems perennial, firm, wide-twining, subglabrous; stipules small, linear or lanceolate; petioles firm, 5 to 15 cm. long; leaflets roundish, usually more or less rhomboidal, often sinuate-lobate, 10 to 15 cm. each way, both sides glabrous or the lower with thinly adpressed gray-silky hairs when young; flowers in ample racemes 10 to 15 cm. long, on firm peduncles often equaling them; pedicels 4 to 6 mm. long; calyx 6.5 to 8.5 mm. deep, silky, the teeth reaching about halfway down; corolla blue, 2.5 cm. deep or more; pod 15 to 22.5 cm. long, 17 to 19.5 mm. wide, glabrescent, subcompressed, distinctly constricted vertically, 9 to 12-seeded; seeds compressed-roundish.

Near Bayamon; near Las Piedras; near Aguada, in mountain woods at Rio Grande; near Aguadilla on mountain slopes.—Cuba (Grisebach), Haiti, St. Thomas, Guadeloupe, Dominica (Grisebach), Martinique, St. Vincent (Kew Bull. no. 81, p. 247), Bequia. Native country not clearly known.

This plant is not only widely distributed in the tropics of Asia and America, but is often cultivated on account of its tuberous root, which resembles a turnip, and is eaten raw or cooked.

Local name, *habilla*.

2. **Pachyrhizus tuberosus** (Lam.) Spreng.

(Urban, 312.)

Herb twining, 3 to 6 meters high; root consisting of a number of simple cord-like fibers, several feet in length, stretching under the surface of the ground, bearing in their course a succession of tubers; leaflets subentire or slightly sinuate (in the young leaves sometimes deeply lobed); raceme almost simple,-the lower branches very short, many-flowered; flowers white; pod 20 to 30 cm. long, 1.8 to 2 cm. broad, constricted between the seeds; seeds red.

Cultivated near Rincon in Hacienda La Palmira. Native country unknown. Mr. Oliver says "I think this plant may well be a variety of *P. angulatus* Rich. originated under cultivation, but so marked as to require a distinct name for cultural purposes, and for the present the specific name given by Lamarck may suitably be adopted."

Cultivated for its large edible tubers. It can be planted at any season of the year, and the roots are fit for digging in 4 or 5 months. The pods of this plant (the yam bean), according to Dr. Trimen, are an admirable vegetable, superior to ordinary French beans in the absence of a fibrous string about the sutures of the pod. The seeds are poisonous. Macfadyen says in the Flora of Jamaica, "The tubers may either be boiled plain, in which state they are a very good substitute for yams and other roots in common use, or they may be submitted to a process similar to arrowroot, and a starch obtained. This starch is pure white and is equal in every respect to arrowroot."

67. DOLICHOS L.

Dolichos L. Sp. Pl. **2**: 725. 1753.
Macrotyloma WIGHT & ARN. Prod. Fl. Pen. Ind. Or. **1**: 248. 1834.
Dolichus E. MEY. Comm. Pl. Afr. Austr. 140. 1835.

Calyx campanulate, the 2 upper teeth united into one entire or emarginate one; standard orbicular, the thickened base appendiculate with inflexed auricles; wings falcate-obovate, adhering to the keel; keel much incurved, usually rostrate, but not spiral; upper stamen free, often appendiculate or incrassate near the base; anthers uniform; ovary subsessile, multiovulate; style thickened upwards, either bearded longitudinally on the inner side or hairy all around, at least around the stigma, which is small and terminal; pod linear or broadly oblong, compressed, straight or curved, the sutures incrassated, the valves nearly flat or slightly convex; seeds thick, compressed. Twining, trailing, or erect shrubs or undershrubs; leaves pinnate; leaflets 3, stipellate; stipules usually small; flowers violet, flesh-colored, yellowish or whitish, sometimes solitary or fascicled, sometimes in racemes; bracts and bracteoles striate, usually small.

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[a] Cook and Collins, p. 208, as *Pachyrrhizus angulatus*.

1. Dolichos lablab L.

(Urban, 312, as *Lablab vulgaris* Savi.)

A wide-climbing perennial with subglabrous stem; leaflets membranous, central one ovate-deltoid, 7.5 to 10 cm. long, broadly spatulately narrowed at the base; flowers in racemes, 7.5 to 15 cm. long; calyx 3.3 to 6.5 mm. long, subglabrous; corolla 1.5 to 1.9 cm. deep, reddish or pale, keel abruptly incurved; style flattened upwards, not twisted, narrowed at the base; pod 3.5 to 5 cm. long, 2 cm. broad, narrowed at the base, the upper suture nearly straight, the faces glabrescent, rarely persistently pubescent; seeds 2 to 4.

There occur also three varieties, one with white flowers, variety *albiflorus* DC., the second with purple flowers, variety *purpureus* DC., and the third with rose-colored flowers.

Cultivated and seemingly wild at Bayamon in gardens; near Caguas; near Mayaguez; cultivated near Rincon and also near Aguadilla, at Espinal.—Bahama (Hitchcock), Cuba (Grisebach), Jamaica, St. Croix, St. Bartholomew (Euphrasén), St. Kitts (Grisebach), Antigua (do.), Guadeloupe, Martinique, St. Vincent, Bequia (Kew Bull. no. 81, p. 247). In the tropics of both hemispheres. Native country probably tropical Africa (Bentham).

This plant is universally cultivated in the tropics, where the young pods and the black or brown seeds are used as a vegetable.

Local names, *frijoles caballeros*, *chicharos*, *cicero*.

SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM

CONTRIBUTIONS

FROM THE

UNITED STATES NATIONAL HERBARIUM

VOLUME X, PART 5

REPORT ON THE DIATOMS OF THE ALBATROSS VOYAGES IN THE PACIFIC OCEAN, 1888-1904

By ALBERT MANN

[Assisted in the bibliography and citations by P. L. Ricker]

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PREFACE.

In the autumn of 1887 the steamer *Albatross*, of the United States Bureau of Fisheries, which had previously been employed on the Atlantic coast of North America, was despatched to the Pacific Ocean, where it has since been engaged in fishery and deep-sea investigations on the western coast of the United States, off British Columbia and Alaska, and also in more distant regions. The bottom samples obtained by the dredge and sounding cup during the several cruises from 1888 to 1904, inclusive, were referred to Dr. Albert Mann, an expert student of the diatoms, for separating out and reporting upon these minute plant organisms, a difficult and painstaking task, the results of which are given in the paper herewith presented.

The titles in the bibliography and the citations throughout the body of the report have, with very few exceptions, been verified from the original papers by Mr. P. L. Ricker, to whom acknowledgment is here made.

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REPORT ON THE DIATOMS OF THE ALBATROSS VOYAGES IN THE PACIFIC OCEAN, 1888-1904.

By ALBERT MANN.

[Assisted in the bibliography and citations by P. L. RICKER.]

INTRODUCTION.

The paper here offered is a report of the diatoms found in the sea dredgings and soundings of the United States Bureau of Fisheries steamer *Albatross*, which covers all the material collected and available up to January 1, 1905, exclusive of what is embraced in a short report already published by the author.[a]

The preliminary work was done in the Smithsonian Institution, Washington, D. C., during the winters of 1899–1900 and 1904–5. The crude material, as a rule bottled and preserved in alcohol, was first examined under the microscope, using magnifying powers ranging from 23 to 590 diameters, so as to discover which gatherings gave promise of affording diatomaceous material. In very many cases no trace of diatoms was discoverable. The gatherings thus selected were then prepared for more accurate investigation by methods that are briefly described as follows:

The mud is first passed through a sieve of bolting cloth with a mesh of about one thirty-second inch, so as to strain out large pieces of foreign material, such as bits of animal tissue, fragments of shells, etc. The alcohol is then eliminated by washing in filtered or distilled water in a glass beaker and decanting of the liquid after all solid material has settled. The mud is next boiled in a beaker with concentrated commercial hydrochloric acid for one-half hour. The acid when cold is decanted and the residue washed with water to get rid of the resultant salts. The material is then boiled in concentrated commercial nitric acid for fifteen to thirty minutes and again washed. This suffices in many instances to destroy all organic matter and to prepare for the further step of separating the diatoms from coarse sand, Radiolaria, etc. Often, however, a third treatment is necessary, especially where the percentage of organic matter is high and where clay is present. The third boiling is in concentrated commercial sulphuric acid. As much water as possible is extracted from the mass by careful decantation and removal of the last drops with a pipette. The acid is then slowly added, the quantity being about ten times the volume of the mass, and the whole is boiled in a porcelain evaporating dish over a sand bath for one-half hour. At the expiration of this time powdered potassium chlorate is slowly added to the boiling acid until the black color gives place to a gray or yellow. Very thorough washing follows this to remove the last trace of acids and salts. In those instances where a fine siliceous flock is present, this can be removed by bringing the washed residue to a boil in a solution of soap, made by adding about 5 per cent of a saturated alcoholic soap solution to distilled water. The soap water holds the flocculent matter in suspension and allows its removal by decantation. As, however, very delicate forms like Chaetoceros, Nitzschia, etc., are liable to be lost by this method, it is to be used only where unavoidable.

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[a] Proc. U. S. Nat. Mus. 16: 303–312. 1894.

The coarse sand, Radiolaria, and like impurities are now removed by rotating the material in a glass evaporating dish. By quickly revolving the lowest point of the dish in a small circle of, say, one-half inch a peculiar motion is given to the contents, on account of which the large sand and other coarse ingredients collect in a mound at the center, while the diatoms are held in suspension. The liquid is quickly poured off from the sand, the process being repeated until the sand is found under the microscope to be free from diatoms. The cleaned diatoms are then preserved in bottles in a 40 per cent solution of alcohol with distilled water.

In the preparations accompanying this report the diatoms were picked up separately with a mechanical finger from strewn masses of the cleaned material and mounted singly in the proper medium, generally Canada balsam. They are attached to the cover glasses of the preparations by a delicate film of acetic-acid gelatin, and so placed as to occupy the center of a minute ring of india ink spun on the glass slide. This mounting each specimen separately as a labeled preparation, although involving much labor, was the only satisfactory method of rendering available for future examination the forms herein described. Strewn slides of diatomaceous material containing certain species, like the H. L. Smith type slides and most of those of Cleve and Möller, are valuable; but every student consulting these for identification must have felt the great inconvenience and uncertainty of hunting among a mass of mixed diatoms for a certain species, the exact appearance of which is, under the circumstances, not known. Only when each species is mounted by itself and in such a position on the slide as to be instantly found under the microscope can diatom preparations be considered worthy to be compared with other scientific specimens of reference.

In addition to these preparations of single forms, representing each species found, this report is accompanied by a series of group slides of selected forms. Each of these preparations has from 10 to 100 diatoms, arranged in rows on the cover glass or massed in the center of the india ink ring. Their purpose is to afford a type gathering of each of the more important diatomaceous dredgings and soundings examined.

As has been remarked, a large number of the *Albatross* gatherings were found to be destitute of diatoms. Naturally, these barren samples included most of those obtained at great depths, say 1,200 fathoms and upward. There are, however, many cases where deep dredgings were particularly rich in diatoms, as, for example, station 3607, having a depth of 987 fathoms, and 3712H, at 1,744 fathoms. It was also found that a considerable number of the gatherings made in shallow water and at points where diatoms would naturally be looked for contained no trace of them. It would certainly be a mistake to infer from the absence of diatoms in most of the deep-sea gatherings and in many of those from shallower places or from the sea surface that none were present at these points. In many instances their absence is to be explained by the methods by which these gatherings were made. It is evident that devices perfectly adapted to securing larger forms of animal and vegetable life may fail completely to retain any specimens of these very minute plants. The modes of making the gatherings, the way they are brought aboard the ship, and the process of assorting the contents would often eliminate all traces of the diatoms, at least of all forms that grow without attachment to other bodies. Diatoms are to be found in richest quantity in the upper and lighter layers of mud of the sea bottoms, and those on the surface of the sea can be secured only when a special appliance is attached to the tow nets. As a consequence, a large majority of the gatherings now in the possession of the U. S. National Museum are destitute of diatoms, although many of them were made at points where with different methods rich supplies could have been secured. The cruise of the *Albatross* under Dr. Alexander Agassiz, just completed, is reported, however, to have resulted in obtaining an unusually rich supply of the diatoms.

I have tried to supply this deficiency of diatomaceous material in some of the dredgings by examining the contents of the stomachs of animals, chiefly holothurians, taken at these points. This is, however, a very partial and unsatisfactory substitute. The stomach contents are generally rich in diatoms, so far as number of individuals is concerned; but as the diatoms would find their way into the stomachs of these animals only in connection with the grosser material on which they feed, the forms thus secured would represent only such as happened to be mixed with or attached to their food. A host of other forms, on or in the sea mud in that vicinity, would therefore be missed entirely.

As our Government, so far as I can learn, has not, previously at least to the last cruise just mentioned, made any special effort to collect the diatoms, in connection with its general gathering of other organic forms, I think it will be opportune to point out here the great importance of this work being thoroughly carried on in the future. The Diatomaceae are not only equally worthy of investigation with other forms of plant and animal life as inhabitants of the ocean surfaces and beds, but they have a unique value, shared by no other forms, for determining important questions regarding the extent and direction of ocean currents and the origin of the materials composing the sea bottoms. This comes from several peculiar circumstances affecting the diatoms: The first is the indestructibility of their siliceous remains; whence it results that, unlike most aquatic plants, they are not subject to decay, those which were formed centuries ago being as well preserved as those of this year's product. This is also true of some other organisms, as the Radiolaria and the siliceous parts of sponges. But, second, the diatoms differ from these in being as a class of such extreme minuteness as to be readily transported by even quite slow ocean currents or surface drifts from their places of origin to remote points and finally sifted down upon the sea bottom. No other organism of permanent structure has any such transportability. Both of the foregoing facts, however, would be of little importance for the purposes mentioned were it not for the third circumstance, that the Diatomaceae constitute an enormous group of plants containing somewhat above 4,000 well-known species. Many of these are exclusively fossil, and are therefore derivable only from those localities on the land where the geological stratum in which they occur crops out and is subject to "weathering" and other methods of detrition, resulting in carrying these forms into streams and rivers and finally into the sea. Other forms, fresh water as well as marine, are peculiar to certain localities; and, in point of latitude, there is a tropical, a temperate, and a frigid flora among the diatoms as well as among the phanerogams. So that when the siliceous remains of these species are discovered on the sea bottom or in surface gatherings there are trustworthy data available for determining their place of origin and consequently the direction and extent of the currents or drifts by which they were transported. A proper tabulation of the species found at the different stations would be, for these reasons, an exact means of tracing ocean currents, and in many instances of determining the origin of the materials composing the sea bottom in which they were found.

The investigations here reported are of value for the purposes just mentioned mainly as a means of illustrating the necessity of wider and more thorough work in this line. Nor can these valuable results be secured unless methods particularly adapted to securing diatoms are added to those commonly in vogue in sea dredgings and surface gatherings. As both the expenditure of time and the expense incident to combining these researches with those already being carried on would be insignificant compared with the results to be obtained, it is reasonable to hope that the necessary measures will be taken.

In the body of this report there will be found many references to the service the diatoms are capable of rendering in the determination of sea currents and of the origin of sea bottoms. A few examples may be cited here. In the United States cable survey from California to the Hawaiian Islands and return,[a] a long series of soundings from the stations numbered 2655H to 3202H were found to be very rich in the rather uncommon quadrate variety of *Biddulphia favus* (Ehrenb.) Van Heur. They constitute a practically unbroken series beginning with station 2912H in latitude 155° 58′ 30″ W., longitude 22° 18′ 00″ N., running westward to the Hawaiian Islands and on the return voyage eastward ending at about the starting point, namely at station 3018H in latitude 155° 57′ 30″ W., longitude 21° 56′ 00″ N. This form, therefore, is as truly a local species at this part of the sea as any phanerogam is of a terrestrial locality. And this is confirmed by one of H. L. Smith's type slides, No. 599, equally rich in this variety, which he says came from the "*Tuscarora* soundings south of Sandwich Islands in 1,468 fathoms," a depth duplicated by several of the soundings in the series just referred to. Similarly on the outward voyage at station 2917H a sounding was made containing, in addition to the quadrate *B. favus* already mentioned, a number of other diatoms, as *Coscinodiscus nodulifer* Jan., *Navicula aspera* Ehrenb., *Navicula lyra* Ehrenb., *Navicula splendida* Greg., *Hemidiscus cuneiformis* Wallich; and on the return voyage at station 3013H these same diatoms were found. The two stations differ in latitude only 6′ 30″ and in longitude only 5′ 30″. This locality is therefore characterized by the foregoing combination of species. Boyer[b] speaks of *Biddulphia robertsiana* (Grev.) Boyer as quite rare and coming from Pacific soundings 20° 10′ 00″ N. and 158° 14′ 00″ W., etc. I found it in large quantities at 21° 21′ 00″ N. and 157° 09′ 00″ W., namely, at station 2920H. So also Boyer discovered his *Biddulphia keeleyi* on the coast of California; and it is abundant in the soundings of station

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[a] Townsend, C. H. Dredgings and other records of the U. S. Fish Commission steamer *Albatross*, Rep. U. S. Comm. Fish. **1900**: 387-562. 1901.

[b] Proc. Acad. Phila. **1900**: 707. 1901.

4505H made near the mouth of Aptos Creek in Monterey Bay, California, in 10 fathoms. *Biddulphia papillata* (Gr. & St.) Mann, is not infrequent at station 2920H, that is, near the west coast of the Hawaiian Islands. The original specimen was discovered in the fossil deposit at Oamaru, New Zealand; but two subsequent finds of this rare diatom, one by Grove and one mentioned by Schmidt,[a] were made in the same vicinity as station 2920H. A solution of the question of origin of these forms at this point of the sea bottom, to which they were necessarily transported (the depth being 570 fathoms), would doubtless be of interest.

Many species first found in Bering Sea and showing their origin in their names, as *Cocconeis arctica* Cleve, have been rediscovered in these investigations at the type localities. References to these coincidences will be found in the text of this work under the several species.

Though not included in the work here reported, I wish to mention another case recently brought to my notice which illustrates the value of diatoms in determining locality on the sea bottom. In the cable survey of the U. S. steamer *Nero* a series of soundings was made over a long belt of sea bottom between the islands of Guam and Luzon which I find are full of the gigantic *Coscinodiscus rex* Wallich, a diatom by no means common, but found here in such enormous quantities that the gatherings are often a pure siliceous mass of the remains of this one species. This belt is over 3,000 miles long east and west and of unascertained width, perhaps 20 miles or a little over. On the return voyage, whenever the ship's course entered this belt great quantities of this diatom were again secured. Thus, for example, at survey station 746, latitude 14° 24′ 00″ N., longitude 135° 31′ 00″ E., 2,788 fathoms, the material is practically pure *Coscinodiscus rex*. Unquestionably such enormous quantities of this single diatom must have been transported to this belt of sea bottom by long-continued and constant currents; and it would therefore be quite possible, by the study of soundings and especially of surface gatherings made in the future, to determine the origin of this vast supply and consequently the trend and extent of the transporting current.

In connection with more thorough and extensive work upon the diatoms for the purposes already mentioned, the Government would be doing valuable service in adding to the supply of available and trustworthy literature on the Diatomaceae. Probably no department of botany is at the present time in such dire confusion and supplied with such meager literature. Many of the authoritative works on the subject were long since out of print, and are either not procurable at any price or so expensive as to make impossible the systematic study of these plants by new investigators. A series of good works easily procured would be a stimulus to further study. As in all special departments of science, the demand for such literature would be limited. But where properly prepared it would be, unlike some forms of scientific literature, permanently authoritative. Many of the works referred to in this report date back to a period of fifty or more years ago, yet remain to-day of the highest value; whereas scientific investigations in other fields, prepared at that date with equal care and skill, are to-day antiquated and worthless.

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[a] Schmidt, Atlas *pl. 167*. 1891.

On account of this scattered and unsatisfactory character of the literature upon this subject, there is some hesitation in publishing the identifications that follow, and in one or two cases in naming the new species here figured and described for the first time. Nearly every work of any merit on this subject has been consulted for this report (see appended list); but if, as is likely, errors have crept in, their correction will be gratefully acknowledged by the writer.

In the following list of genera and species the authors quoted are those who first formed and applied the names now given. But in many instances subsequent investigators have so modified and reconstructed the original conceptions as to entirely change their application. There are a few instances in which the development of a peculiar genus concept has been the gradual product of many investigators, who have more or less perfected the genus as it now stands. It would be practically impossible to give credit to all these scientists without going into the subject of nomenclature beyond the limits of space justified in a descriptive report of this kind. In such instances reference is therefore made to such works as contain an accurate and thorough history of this development. Thus, for example, the genus Coscinodiscus was formed by Ehrenberg in 1840, but included many forms now classed elsewhere, while it excluded some forms now recognized as members of this genus. Rabenhorst, Gregory, Greville, W. Smith, Van Heurck, Grove, Grunow, Rattray, and others have helped to modify and correct the original boundary of Ehrenberg's conception.

From some genera all the original species have been removed, the name still being retained "emended" for a group of diatoms wholly different from that to which it was originally applied. This method of work will hardly meet with the approval of present systematists. A careful examination of the original publication and application of all genera of Diatomaceae will be necessary before their classification can be placed on an enduring basis.

A critical study by Mr. Ricker of the literature bearing upon the types of over one hundred genera included in this report has demonstrated the impracticability of extending this work to include all the generic names here considered, as the time required would seriously delay the publication of the report. The traditional application of the generic names has therefore been followed in the majority of cases, the few changes made being on account of an earlier known valid name or homonym.

In synonymy, also, both as to genera and species, a strictly exhaustive list has not here been attempted. There are instances where the horde of synonyms would be so great as to become most misleading unless accompanied by extensive explanations. Thus, this same genus Coscinodiscus is wholly or partly synonymous with Symbolophora Ehrenb., Endyctia Ehrenb., Odontodiscus Ehrenb., Heterostephania Ehrenb., Cestodiscus Grev., Cosmiodiscus Grev., Stoschia Jan., Janischia Grun., Micropodiscus Grun., Willemoesia Castr., Ethmodiscus Castr., etc. To enter into a discussion of the intersecting boundaries of all these untenable genera and discuss the reasons for their abandonment would be quite foreign to the purpose of this report. With species the synonyms are even more abundant. Thus, for example, *Actinocyclus ehrenbergii* Ralfs has somewhat over 120 synonyms. Manifestly to give in full this and similar lists in a work of this kind would be to obscure rather than to aid the purpose here in hand, namely, a report of the Diatomaceae found by the steamer *Albatross*. Therefore, as has been stated, a strictly exhaustive list of synonyms has not always been attempted. In a few instances where the number is abnormally large the writer has omitted those which are so trivial and obscure as to give no promise of being useful in the future study of these plants.

The generic and specific names assigned are given according to the rules now generally prevailing in botanical nomenclature. This has necessitated in some instances the substitution of obscure and inappropriate names for those universally known and recorded among living diatomists. The writer feels it to be a grave misfortune, for which some remedy should be found, that no alternative is provided in these cases. At this time, when the much-needed systematizing of our nomenclature is being attempted and drastic measures are being taken to that end, it should be possible by the concurrence of living diatomists (the number of whom is not great) to agree to the preservation of a few classical names, and especially the names of certain genera by making them exempt from these changes. This would save the most valuable works of the science from being unintelligible to future students, and would in no wise interfere with the application of strict rules to new cases in the future. The genera and species needing this exception are so few as to make this suggestion wholly practicable, and the writer sincerely trusts that some scheme will be devised to retain certain names universally known to the science which have been set aside in this work for the first time. Thus would be preserved the old name Pleurosigma for Gyrosigma; the old name Aulacodiscus for Tripodiscus; the old name Arachnoidiscus for Hemiptychus; the old name Rhabdonema for Tessella. It is little short of vandalism to call that universally known diatom *Pleurosigma angulatum* by the hitherto unknown compound here applied to it, *Gyrosigma thuringicum.*

The large number of citations to diatom literature in this report, together with the many taxonomic questions involved, have demanded a most careful review of the manuscript. This has been undertaken by Mr. P. L. Ricker, of the Department of Agriculture. The task has been accomplished with such accuracy and thoroughness as to greatly increase the value of these portions of the report. In expressing here my thanks to Mr. Ricker for his able cooperation I wish at the same time to state that I hold myself alone responsible for any errors in identification or any untenable positions in taxonomy that may here occur.

The long list of stations at which the material obtained has been found to be destitute of diatoms is here omitted. The appended list of stations will be found to give the exact location of each station by latitude and longitude, the sea temperature at the surface and at the bottom, the depth in fâthoms, the character of the sea bottom, and the general position along the coast. By referring in this table to the stations mentioned under each species all the available data regarding any diatom or any diatomaceous gathering can be secured without the text being cumbered with repetitions. There is also added a full bibliography of works used in preparing this report.

The purposes of these investigations have been three:

First. That of contributing to the systematic study of this group of plants.

Second. That of affording a collection of carefully identified specimens of all species here enumerated, including the types of all new species herein named, for the use of future investigators. This has been placed at their disposal in the United States National Museum.

Third. That of calling attention to the value of further investigations in this field for the purposes previously discussed—namely, for throwing valuable light upon certain meteorological and geological problems connected with marine investigations.

ALBERT MANN.

U. S. NATIONAL MUSEUM,
Washington, D. C., March, 1906.

ANNOTATED CATALOGUE OF GENERA AND SPECIES.

The following key to the genera included in this report is offered merely as an aid in identifying these genera. From a phylogenetic standpoint its value is probably small. The arrangement is practically that of F. Schutt in Engler & Prantl's Pflanzenfamilien,[a] the changes being mainly the restoration of the earlier names of some of the genera in the place of those given by Schutt. Some slight rearrangement has been found necessary, for reasons explained in the text, as the placing of Vanheurckia, Reicheltia, and other genera under Frustulia, and the closer union of Actinocyclus with Coscinodiscus. Minor changes in the wording were also required in a few places. This general arrangement of Schutt appears more workable than that of H. L. Smith,[b] on which it is partly based. They both avoid the fatal difficulty of the classification of Pfitzer,[c] worked out on the basis of chromatophores, etc., of the living cell. Although Pfitzer's arrangement is of great biological value, its distinctions are so uncertain of application to the diatoms as a class, the great majority of which are known only in a fossil state, that it can never come into general use from a taxonomic standpoint.

No attempt is made here to carry the classification down into the separate species of the different genera. Despite the great industry and ability in making keys to the species based on verbal distinctions exhibited in the monographs of Cleve, Rattray, and other diatomists, the writer must confess to his inability to use these with any feeling of security. Verbal descriptions are very valuable, but without accompanying illustrations they are rarely conclusive. The differences between species being based on the varied and often immensely complicated sculpturing of the valves, it is almost impossible to describe these differences clearly and at the same time tersely enough to serve the purpose of analysis. A good photograph or drawing of a diatom will always be of more value for identification than any amount of word painting. As it is not practicable to accompany this report with figures of all the species here enumerated, copious references are given to works in which satisfactory illustrations are to be found.

SYNOPTICAL KEY.

Subfamily I. **CENTRICAE.** Valve centrally built; that is, arranged in relation to a central point or focus rather than in relation to a median line; outline circular, oval, or elliptical, sometimes polygonal, rarely crescent-shaped or spindle-shaped; neither a raphe, cryptoraphe, nor pseudoraphe present; valve-markings either concentric, radial, decussating, or irregular, never pinnate; processes (horns, spines, etc.) common.

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[a] Pflanzenfamilien, A. Engler & K. Prantl, Theil I, Abteilung 16. Leipzig, 1896.

[b] Conspectus Diatomaceae, H. L. Smith, The Lens 1: 1–19, 72–93, 154–157. 1872.

[c] Hanst. Bot. Abhand. 3: 1871.

A. Valve circular, its surface flat or convex, sometimes hemispherical; zonal diameter generally shorter than valval (except in a few species of Melosira and Stephanopyxis); spines frequent; horns, when present, small. (DISCOIDEAE.)

- a. Valves circular; not divided into definite sectors by ridges or partitions, though sometimes having radial lines of interrupted dashes. (COSCINODISCEAE.)
  - *a*. Frustules usually united into chains; each frustule in zonal view short-cylindrical, spherical, or nearly lenticular; zone sculptured. (MELOSIRINAE.)
    - Chains usually of many frustules; marking of valve either uniform and delicate or with a hyaline or rugose central area surrounded by a strongly sculptured band; no true central umbilicus................................*Melosira* (p. 236).
    - Chains usually short, of not more than 2 to 4 frustules; valve never having a strongly sculptured external part or band; a distinct central umbilicus, granular, usually contrasting strongly with the rest of the valve and separated from it by an evident wavy ridge or line; diameter of the umbilicus varying from one-half that of the valve to very minute, in extreme cases disappearing; marking of the rest of the valve delicate, radially arranged, generally of the watch-case milling pattern; sometimes divided into obscure sectors by radial delicate lines............................*Podosira* (p. 240).
    - Chains of many or few frustules united to each other by spines; zonal diameter of each frustule equaling or much exceeding the valval; no central umbilicus or hyaline area; valve having generally one or more circles of strong marginal or submarginal spines, (rarely near the center or scattered,) uniting the frustules into a chain............*Stephanopyxis* (p. 243).
  - *b*. Frustules solitary; zone narrow, hyaline, or in rare cases obscurely dotted; valve circular, surface slightly convex, rarely strongly convex, sometimes approaching flat or barely concave. (COSCINODISCINAE.)
    - Valve uniformly marked, with a hexagonal network or with beading arranged in radial, concentric, or decussating order; no central area sharply separated from the outer portion and strikingly contrasted with it by difference in character or coarseness of marking; marginal spines wanting or minute.
      - Valve without pseudonodule near or at the margin. *Coscinodiscus* (p. 246).
      - Valve with a pseudonodule near or at the margin. *Actinocyclus* (p. 260).
    - Valve with two strongly contrasted areas of different markings; a large clearly separated, slightly depressed central area marked with network or beading, and a broad encircling area or band marked with network of different sized mesh from that of the central area; margin of valve massive; no marginal spines ....*Craspedodiscus* (p. 264).
    - Valve with two strongly contrasted areas; a central area hyaline or lightly marked with radiating dotted lines, and a broad or narrow encircling area or band strongly marked with radial costea or lines of beading and usually bearing a row of submarginal spines; a portion of the central area is concentrically or excentrically elevated, so that the valve profile, as seen in zonal view, appears undulate.............*Cyclotella* (p. 265).

b. Valve circular, divided into complete or incomplete sectors by radiating ridges or wide hyaline limbs; no horns or prominent spines. (ACTINODISCEAE.)

a. Valve partly or fully divided into sectors by radiating ridges running from the margin toward or to the center; marking strong; margin massively sculptured; no process at the marginal end of the dividing ridges; sectors all on one plane. (STICTODISCINAE.)

Valve surface flat or nearly so; radial ridges many, the main ones reaching the generally rosetted center; more or less united to each other by concentric cross lines, thereby giving a spider-web sculpturing to the valve; outline of valve uniformly circular.................... *Hemiptychus* (p. 266).

Valve surface often elevated at the center, one valve of the frustule more so than the other; radial ridges generally few, rarely reaching the center, which is without a rosette; no definite concentric lines forming a spider-web pattern, though a shadowy reticulation is sometimes present. Outline of valve sometimes polygonal...................... *Stictodiscus* (p. 267).

b. Valve divided into sharply distinct sectors by radial ridges uniformly running from the margin to the hyaline central area; small but evident spines usually at the marginal ends of these dividing ridges; alternate sectors generally depressed; that is, sectors in two planes (ACTINOPTYCHINAE)........... *Actinoptychus* (p. 269).

c. Valve sharply divided into sectors by broad hyaline bars or limbs running from a hyaline center toward or to the margin, their outer ends marked with a minute wart or spine; the hyaline center divided into more or less wedge-shaped divisions confluent with the limbs; spaces between the radiating limbs marked with fine but closely set beading, arranged in radial or decussating order. (ASTEROLAMPRINAE.)

Radiating limbs all of the same width and generally tapering to the margin; central area either reticulated or divided by straight lines into the same number of parts as the limbs. *Asterolampra* (p. 272).

One of the radiating limbs narrower than the others; limbs not tapering to the margin; central area never reticulated; unequally divided into the same number of parts as the limbs by zigzag lines........................ *Asteromphalus* (p. 273).

c. Valve circular; surface imperfectly divided into sectors by alternate undulating elevations and depressions, which are highest and lowest at the margin and decrease or disappear toward the center; each elevation bearing at its highest point a blunt nipple-like horn, pointing radially outward and upward. (TRIPODISCEAE)............ *Tripodiscus* (p. 277).

d. Valve circular or round elliptical; surface marked with two (rarely more or only one) large opposite submarginal ocellae or ringed eyes, slightly or considerably elevated above the plane of the valve; valve markings of beading, lines, or both, arranged symmetrically with reference to the ocellae. (AULISCEAE)............................ *Auliscus* (p. 281).

B. Valve oval or circular; frustule long-cylindrical, the zonal diameter much exceeding the valval; zone made up of a series of rings or imbricated bands, without internal septa; frustules united into chains by their valves. (SOLENOIDEAE.)

Valve in the form of a tall, tapering cone, its apex excentrically placed and tipped with a stout, sometimes very long, hollow bristle or spine. *Rhizosolenia* (p. 283).

C. Frustule a box, with zonal diameter generally shorter, sometimes slightly longer, than the valval diameter; valve generally oval, sometimes polygonal, circular or semicircular; unipolar, bipolar, or multipolar, each pole represented by an angle or (in Chaetoceros) by a horn or spine or by both angles and horns. (BIDDULPHIOIDEAE.)

a. Horns much longer than the frustule, not tipped with a claw; frustules in chains; valve circular or oval. (CHAETOCEREAE). *Chaetoceros* (p. 285).

b. Horns generally shorter than the frustule; when longer, only slightly so and then tipped with a claw. (BIDDULPHIEAE.)

a. Valve tripolar to multipolar; angles not bearing dome-like protrusions or horns; not tipped with a claw. (TRIGONIINAE.)

Valve strong; marking distinct; no central erect spine. *Trigonium* (p. 289).

Valve delicate; marking delicate; a central erect spine. *Ditylum* (p. 296).

b. Valve generally bipolar, sometimes tripolar to multipolar; each angle bearing a dome-like protrusion or a horn; not tipped with a claw. .... *Biddulphia* (p. 298).

c. Valve unipolar, oval; frustule having zonal diameter longer than valval; valve massively sculptured, unsymmetrically elevated. (Isthmiinae.) *Isthmia* (p. 311).

d. Valve bipolar, tripolar, or quadripolar, each angle having a long vertical horn tipped with a claw; or in the bipolar form either as described or having the angles of only one valve turned vertically upward into short-pointed ends without claws. (HEMIAULINAE.)

Frustule in zonal view not concavo-convex, but having two similar valves; valve bipolar, tripolar, or quadripolar, each angle having a long vertical horn tipped with a claw...... *Hemiaulus* (p. 312).

Frustule in zonal view strongly concavo-convex; the apices of the concave valve being sharply turned up into a short point destitute of a claw; center of this concave valve raised into a strong dome, lacking on the convex valve; in valval view the dome is seen to be imperceptibly merged into the rest of the valve, not separated from it by a strong rectangular ridge.......... *Ploiaria* (p. 313).

c. Horns rudimentary, reduced to low domes, or wanting; frustule in zonal view having a rectilinear outline; internal septa massive, with enlarged ends. (ANAULEAE.)

Internal septa straight, except at the tip, which is sharply bent toward the center of the frustule and enlarged into a bulbous end, so that each septum resembles a music note................. *Terpsinoe* (p. 314).

Internal septa not straight, beginning as transverse septa on the valves near their extremities, proceeding vertically downward parallel to the zonal axis, then twice bent and extending parallel to the longitudinal axis to near the center of the frustule, similar to the internal septa in Grammatophora, the ends straight and moderately enlarged. *Porpeia* (p. 315).

d. Horns wanting; valve without internal septa, semicircular, broader than long; frustule in zonal view cuneate. (HEMIDISCEAE). *Hemidiscus* (p. 316).

D. Valve narrow or broad spindle-shaped; ends elevated or knobbed; marking generally radial; center of valve usually bearing a massive process, shaped like the Greek epsilon and interlocking with the process of the next valve, thereby uniting the frustules into chains. (RUTILARIOIDEAE)..... *Rutilaria* (p. 317).

Subfamily II. **PENNATAE.** Valve not centrally built; that is, not arranged in relation to a central point or focus, but rather to a median line; outline generally boat-shaped or rod-shaped, sometimes oval, cuneate, crescent-shaped, or sigmoid; markings generally pinnate or transverse (imperfectly radiate in some species of Campylodiscus); true raphe, or hyaline median line (pseudoraphe), or raphe obscured by lateral wings or keel (cryptoraphe) always present; processes (horns, spines, etc.) uncommon.

A. No true raphe; a hyaline median line (pseudoraphe) present, rarely obscure. (FRAGILARIOIDEAE.)

  a. Frustules united to form a ribbon or zigzag chain; outline in zonal view rectilinear; zone generally composed of separate bands; valve long-oval or lanceolate. (TABELLARIEAE.)

    a. Frustule in zonal view unbent; valves not concave and convex. (TABELLARIINAE.)

      Valve transversely partitioned by internal vertical septa; that is, perpendicular to zone in zonal view........*Denticula* (p. 318).

      Valve not transversely partitioned (may be transversely undulate, species of Grammatophora); internal septa parallel to zone in zonal view.

        Internal septa massive, generally undulate, approaching from either end of the frustule toward but not to the center, leaving a nonseptate central space which appears in valval view as a central oval in each valve; zone hyaline or longitudinally dotted............................*Grammatophora* (p. 319)

        Internal septa delicate, discontinuous, not undulate, interrupted at three or more places, the nonseptate spaces appearing in valval view as so many ovals along the valve; zone or zonal bands transversely marked..........*Tessella* (p. 321).

    b. Frustule in zonal view bent; one valve concave, the other convex. (ENTOPYLINAE.)

      Valve transversely ribbed, the ribs on one side of the median line alternating with those on the other side, the median line therefore zigzag; internal septa on each side of the valve pierced with oval openings set in a straight row parallel to and near margins of the valve...*Entopyla* (p. 323).

      Valve transversely ribbed, the ribs on one side of the median line continuous with those on the other side, the median line therefore straight; internal septa on each side of the valve pierced with oval openings set in a zigzag row parallel to but distant from the margins of the valve........................*Gephyria* (p. 324).

  b. Frustule solitary, or united into a fan or forming a spiral band; not forming a ribbon or zigzag chain; outline in zonal view rod-shaped or wedge-shaped; valve club-shaped. (MERIDIONEAE.)

      Zone composed of separate bands; internal septa pierced by a row of large oval openings which in valval view give a stepladder appearance to the club-shaped valve....................*Climacosphenia* (p. 325).

  c. Frustules united to form a ribbon or zigzag chain; zone not composed of separate bands. (FRAGILARIEAE.)

    a. Valve with transverse septa. (DIATOMINAE)...*Plagiogramma* (p. 325).

    b. Valve without transverse septa. (FRAGILARIINAE).
Dimeregramma (p. 327).

B. Frustule having one valve with true raphe, the other with distinct or obscure hyaline median line (pseudoraphe). (ACHNANTHOIDEAE.)

  a. Frustule in zonal view bent, one valve concave, the other convex; outline of valve long-oval or boat-shaped. (ACHNANTHEAE).*Achnanthes* (p. 327).

  b. Frustule in zonal view straight; outline of valve broad-oval or nearly round. (Cocconeideae)...................................*Cocconeis* (p. 328).

C. True raphe generally evident; valve generally not keeled; if keeled, the raphe coincident with keel (Nitzschia). (NAVICULOIDEAE.)

- a. Valve with evident raphe; keel generally absent, or when present, without beading; markings generally pinnate. (NAVICULEAE.)
  - *a.* Frustule not wedge-shaped in either zonal or valval view; valve straight or sigmoid; never crescent-shaped. (NAVICULINAE.)
    - Frustule without internal compartments along the margins of the valves.
      - Valve without keel. (NAVICULIDAE.)
        - Raphe straight or barely undulate, its tips turned toward the same side of the valve; outline of valve boat-shaped. (NAVICULAE.)
          - Halves of the raphe not surrounded by an elevated parallel ridge; both ends of each half terminating in a rounded or elongated bead; central and terminal nodules of valve round or broadened transversely. *Navicula* (p. 333).
          - Halves of raphe surrounded by an elevated parallel ridge, the ends not terminating in beads, or rarely the outer end of each half terminating in a round bead; central nodule greatly narrowed laterally and prolonged longitudinally, thereby separating the two halves of the raphe by a ridged space of from one-sixth to fully two-thirds the length of the valve. *Frustulia* (p. 359).
        - Raphe strongly curved into an S, rarely into a C; sides of valve usually corresponding to the same curve; marking uniform over entire valve, of fine, closely set lines, arranged either in two series, one transverse and one longitudinal, or in three series, one transverse and the other two at angles of 60° to each other; tips of the raphe turned to opposite sides of the valve. (GYROSIGMAE.) *Gyrosigma* (p. 362).
      - Valve with keel. (AMPHIPRORIDAE.)
        - Raphe straight, not median........... *Plagiotropis* (p. 367).
        - Raphe sigmoid, median............... *Amphiprora* (p. 368).
    - Frustule with internal compartments along the margin of the valve. Characters, except the lateral compartments, the same as in Naviculae. (MASTOGLOIAE)............. *Mastogloia* (p. 368).
  - *b.* Frustule wedge-shaped in both the zonal and valval view; valve straight. (GOMPHONEMINAE)............... *Gomphonema* (p. 370).
  - *c.* Frustule wedge-shaped as to its transverse axis, that is, the two valves approaching nearer on one side than on the other; valve more or less crescent-shaped. (COCCONEMINAE.)
    - Valve without transverse ribs; raphe evident.
      - Valve not strongly asymmetrical; the raphe nearer the median line than the concave side of the valve; zone narrow, hyaline.. *Cocconema* (p. 371).
      - Valve strongly asymmetrical, the raphe much nearer the concave side of the valve than the median line; zone wide, composed of several bands, beaded............ *Amphora* (p. 373).
    - Valve with transverse ribs; raphe obscure or represented by a form of pseudoraphe consisting of a continuous bow-shaped ridge. *Cystopleura* (p. 377).

b. Valve apparently without raphe, this being obscured by the beaded, marginal keel; markings always transverse. (Nitzschieae).
Nitzschia (p. 378).

D. Raphe hidden in lateral winged keel. (Surirelloideae.)
a. Valve surface undulated in a series of transverse depressions and elevations .... *Sphinctocystis* (p. 382).
b. Valve surface not undulated in a series of transverse depressions and elevations.
a. Valve outline elliptical, ovoid or rarely long-lanceolate; marked with transverse ribs not quite extending to the center, thus leaving a hyaline median line; valve surface nearly flat, rarely spirally twisted; keel winged .... *Surirella* (p. 383).
b. Valve outline nearly circular; ribs or other markings radial; valve surface saddle-shaped, rarely almost flat; keel not winged.
Campylodiscus (p. 386).

MELOSIRA C. Ag.

Melosira C. Ag. Syst. Alg. 8–9. 1824. Kütz. Bacill. 48, 52. 1844; Sp. Alg. **30.** 1849; Linnaea **8:** 70. 1833. Ralfs, Ann. Mag. Nat. Hist. **12:** 346. *pl. 9.* 1843. Thwaites, Ann. Mag. Nat. Hist. II. **1:** 167. 1848, in part. W. Smith, Synop. Brit. Diat. **3:** 54. 1856. Pritch. Hist. Infus. ed. 4. 815. *pl. 5. f. 62–65, 71.* 1861. Rabh. Fl. Eur. Alg. **1:** 7, 37. *f. 8.* 1864. Griff. & Henf. Micr. Dict. ed. 4. 494. *pl. 17. f. 5–6, 15.* 1883. Castr. Rep. Voy. Chall. Bot. **2:** 92. *pl. 21. f. 1–2.* 1886. Van Heur. Synop. 197. *pl. 85–91.* 1881; Treat. Diat. 438. *f. 165–168, pl. 18. f. 608–613, pl. 19. f. 614–624.* 1896. Brun, Diat. Alp. 134. *pl. 1. f. 1–5, 9.* 1880.
Gaillonella Bory, Dict. Hist. Nat. **7:** 101. 1825, not Bory. 1823.
Gallionella Ehrenb. Infus. 166. 1838. De Toni, Syll. Alg. **2:** 1331. 1894.
Lysigonium Link; Nees, Hor. Phys. Berol. 4. 1820? O'Meara, Proc. Roy. Irish Acad. II. **2:** 248. *pl. 26. f. 4.* 1875. De Toni, Syll. Alg. **2:** 1328. 1894.
Orthoseira Thwaites, Ann. Mag. Nat. Hist. II. **1:** 167. 1848, in part. W. Smith, Synop. Brit. Diat. **2:** 59. 1856.
Aulacoseira Thwaites, Ann. Mag. Nat. Hist. II. **1:** 167. 1848, in part.
Paralia Heib. Krit. Overs. Danske Diat. 33. 1863, in part. De Toni, Syll. Alg. **2:** 1349. 1894. Grun. Denkschr. Akad. Wien **48**^{2}: 93. 1884. Cleve, Bih. Sv. Vet. Akad. Handl. **1**^{13}: 7. 1873.

Two generic names antedate Agardh's Melosira. The first is Lysigonium Link. It seems that his type species was one of the then indefinitely fixed algae called *Conferva moniliformis*, but was probably not a diatom. At least Ehrenberg so contends.[a] Link himself, according to Ehrenberg, abandoned the name in 1824. If it can be unmistakably proved to have been applied to a diatom of this character, Link's name must replace that of Agardh. The second name is Gallionella (Gaillonella), given by Bory St. Vincent in 1823, but without definite outline or the enumeration of any species. Two years later, 1825, in the same work Bory does describe two species, *G. nummuloides* and *G. moniliformis*. But in the preceding year, 1824, Agardh gave the generic name Melosira to these diatoms and described five species. This name is therefore valid, unless, as above stated, Link's Lysigonium can be clearly identified with this genus. The genus has been variously divided by different authors. The most important attempt at division, a thing desirable in itself on account of the large number of species in the genus, was carried out by W. Smith,[b] based on the analysis of Thwaites.[c] Smith accepts the division of this genus into two, viz: Melosira (Ag.) Thwaites and Orthosira Thwaites, rejecting, however, Thwaites's third genus Aulacoseira. Smith defines the two as follows: Melosira, "Filaments cylindrical, of numerous frustules, attached or free; frustules spherical or subcylindrical, more or less convex at the junction surfaces;" Orthosira, "Filaments cylindrical, of numerous frustules, continuous, attached or free; frustules and valves cylindrical; junction surfaces plain, line of junction usually spinous or denticulated." Schmidt, in his Atlas, and a few other authors have adopted this division, but as a general rule the distinctions are felt to be too unimportant and inconstant to warrant the change. Many authors, as Van Heurck, while rejecting Smith's division, have made use of these minor differences within the genus for subgeneric classification. The untenable proposal of H. L. Smith to unite this genus with Podosira and Hyalodiscus will be discussed under the name Podosira in this report.

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[a] Ehrenb. Infus. 166. 1838.
[b] W. Smith, Synop. Brit. Diat. **2:** 54. 1856.
[c] Ann. Mag. Nat. Hist. II. **1:** 167. 1848.

Melosira ? coronaria Mann, sp. nov. PLATE LI, FIGURES 1, 2.

Valves consisting of two portions: First, a broad border curving downward, its outer half closely punctate with shining granules and its inner half marked with fine radiating lines closely set, the line of division between the punctate and striate halves being a wavy one; second, a central area raised above the border by a cylindrical hoop, seen in the zonal view, this central area being flat and perfectly hyaline. In the zonal view of the valve is seen, rising above the curved border, the before-mentioned hoop or band, the lower two-thirds of which is cylindrical and terminates in a row of small but stout tubular processes equidistant and having blunt ends, extending obliquely outward and upward, their bases surrounded by a fringe of irregular spines. Between each pair of these processes are one to three smaller ones. The upper one-third of the hoop or band, that is, between the ring of processes and the flat hyaline top, is a flaring ornamented rim. The cylindrical lower two-thirds of the hoop or band is covered with minute beading, arranged in regular 3-line order; the upper flaring one-third of the hoop or band is covered with fine vertical lines forming a leaf-like sculpture by each of four or five bending together at the top.

Diameter of valve, 0.83 mm.; height of valve (zonal view), 0.25 mm.

This diatom is certainly generically the same as *Porodiscus* (*Pyrgodiscus* ?) *calcyflos* Temp. & Brun,[a] which is the same as *Porodiscus interruptus* Gr. & St.,[b] this in turn being the same as *Porodiscus hirsutus* Gr. & St.,[c] Grove and Sturt's specimens being the inner area of Tempère & Brun's. It is even closer to what Schmidt calls *P. calcyflos* Temp. & Br.[d] which is misnamed, as his figures 10, 11 of the same plate, called *P. hirsutus* Gr. & St. are Tempère & Brun's type. If, therefore, my specimens are to follow the generic assignment of these very similar forms, they would bear the name *Porodiscus coronarius* Mann. But I am convinced that this generic name is utterly inapplicable to all these forms. They have nothing in common with Greville's genus except the central pore-like area.[e] As even this disappears in the figures of *P. calcyflos*,[f] and in my own specimens, this character, totally inadequate in itself, is eliminated and there does not remain any semblance to the Porodiscus type. Neither can they be included in Pyrgodiscus Kitt.[g] Tempère & Brun suggest this idea by bracketing Pyrgodiscus with their name. But Kitton's genus, with its central tower-like elevation (whence the name) bearing four enormous spines with four more a little lower and alternating, and a ring of smaller but stout spines around the basal rim, has a massive and unique aspect to which there is no analogy in the forms here under consideration. A very much closer affinity is found in Melosira. Many members of this genus have a level central area elevated above the rim by a cylindrical or conical hoop or band. In fact this might almost be said to be characteristic of the genus. For example, see *M. saturnalia* Brun,[a] where even the flaring upper rim of the band or hoop, described above, is perfectly paralleled; also *M. ferox* Schmidt,[b] where the ring of zonal processes is also paralleled. If we also remember, we have here to do with small diatoms, *P. calcyflos* being 0.06 to 0.075 mm. and *M. coronaria* 0.83 mm. in diameter, we shall see we are well within the average size of Melosira. It will perhaps be eventually preferable to construct a new genus for these allied forms, especially if other species are found which retain the essential characteristics of those already known; and this would have the advantage of simplifying somewhat the complex group of forms now included in Melosira. Careful attention to the description and the figures of *M. coronaria*, especially to the zonal view, will show that it is clearly distinct from the Oamaru or Japan specimens.

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[a] Mem. Soc. Phys. et Hist. Nat. Geneva **30**^{9}: 50. *pl. 4. f. 11, 11a*. 1889.

[b] Journ. Quek. Micr. Club, II. **3**: 67. *pl. 5. f. 8*. 1887.

[c] Op. cit. 143. *pl. 14. f. 54*.

[d] Schmidt, Atlas *pl. 158. f. 8, 9*. 1890.

[e] Cf. Porodiscus Grev. Trans. Micr. Soc. Lond. n. s. **11**: 63. *pl. 4. f. 1–5*. 1863.

[f] Schmidt, Atlas *pl. 158. f. 9*. 1890.

[g] Journ. Quek. Micr. Club II. **2**: 173. *pl. 13. f. 13 a–c*. 1885.

Type in the U. S. National Museum, No. 590116, from station 2807, Galapagos Islands, April 4, 1888; 812 fathoms, bottom of Globigerina ooze and coral mud.

Melosira febigerii (Grun.) Mann.

Podosira febigerii Grun. in Cleve & Grun. Sv. Vet. Akad. Handl. 17^2: 119. 1880. Van Heur. Synop. *pl. 84. f. 22–24.* 1881. De Toni, Syll. Alg. **2**: 1362. 1894.

I see no reason for including this form, nor the others so named in the above plate of Van Heurck, in the genus Podosira. If that genus is to be defined as it generally is (for full details of which see under Podosira in this report), and if Melosira and Podosira are to retain any valid marks of distinction, such forms as the above can not be separated from Melosira. In order to avoid repetition in this report, the position of the author in this matter must be considered in connection with his remarks under the genus Podosira.

As both Grunow and De Toni observe in the above citations, there is some resemblance between this species and the more robust and coarsely marked *P. hormoides* (Mont.) Kütz.,[c] a species, by the way, that Montagne rightly renamed ***Melosira hormoides***.[d]

Found at station 3607, Bering Sea.

Melosira medusa Mann, sp. nov. PLATE L, FIGURE 3.

Valve with border and central area; the latter about four-fifths the diameter of the valve, has in its center a low, rugose, broad knob or boll, the rest of the area being thinly spotted with irregular flecks. The border, one-fifth the radius in width, begins internally in a row of small, granular, wedge-shaped markings, from the points of which proceed fine wavy lines to the margin. A circle separates this granulated part of the border from the outer portion. The latter, three-fourths the width of the entire border, is delicately marked with transverse lines proceeding from the points of the granular wedges, as above stated, and with finer lines interspersed between them. The lines sometimes anastomose.

Diameter of valve, 0.078 mm.

An unnamed figure of Schmidt's[e] has some resemblance to this species, though it seems entirely to lack the peculiar circle of small beaded triangles within the striated border. Schmidt there says, "Nach Grove vielleicht eine innere Schale von Stephanopyxis, vielleicht zu einem andern Genus zu ziehen." Neither of these suggestions seems to me good. This figure of Schmidt's is practically identical with an earlier one[a] there marked "fraglich." There is also some resemblance, especially in the striation of the border, to *Melosira imperfecta* Herib.[b] The above name refers to the resemblance of this species to some of the disciform Medusae.

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[a] Schmidt, Atlas *pl. 180. f. 24–25.* 1892.

[b] Op. cit. *pl. 180. f. 23.*

[c] Kütz. Bacill. 52. *pl. 29. f. 84.* 1844.

[d] Mont. in d'Orbig. Voy. Amer. Merid. **7**: 2. 1839.

[e] Schmidt, Atlas *pl. 202. f. 6.* 1896.

Type in the U. S. National Museum, No. 590117, from station 3346, off Washington, September 22, 1890; 786 fathoms, bottom of green mud.

Melosira (sulcata var.?) **scopos** Mann, sp. nov. PLATE L, FIGURE 4.

Valve circular, convex; the center marked with a beaded circle one-fifth the valve's diameter, the beads set wide apart in regular quadrate order; surrounding this a rugose ring extending to one-fifth the radius from the border and separated from this by a narrow hyaline band; border narrow, massive, ornamented with a double row of alternating beads; diameter of valve, 0.07 mm.

The form most nearly resembling this species is an unnamed figure of Schmidt's,[c] which, with the above, might be classed as very wide varieties of *Melosira sulcata* (Ehrenb.) Kütz. But such an identification would be altogether unsatisfactory. My species also shows a slight likeness to *Cyclotella umbilicata* (Ehrenb.) Ralfs, as figured (*Discoplea umbilicata* Ehrenb.) by Ehrenberg;[d] but, as Ralfs says,[e] though represented in Ehrenberg's figure with a punctate center that diatom has a smooth central umbo, and it is so described by Ehrenberg.[f] Ehrenberg's species is probably identical with *Melosira westii* W. Smith.[g]

Type in the U. S. National Museum, No. 590118, from station 3712H, Okhotsk Sea, September 4, 1896; 1,744 fathoms, bottom of green sand and fine mud.

Melosira sol (Ehrenb.) Kütz. Sp. Alg. 31. 1849. Pritch. Hist. Infus. ed. 4. 819. 1861. Van Heur. Synop. *pl. 91. f. 7–9.* 1881. Schmidt, Atlas *pl. 179. f. 21.* 1892. De Toni, Syll. Alg. **2:** 1341. 1894. Wolle, Diat. N. A. *pl. 58. f. 1–2.* 1890. Truan & Witt, Diat. Hayti, 17. *pl. 4. f. 18.* 1888. Castr. Rep. Voy. Chall. Bot. **2:** 93. *pl. 10. f. 3, pl. 17. f. 3, pl. 21. f. 7.* 1886.

Gallionella sol Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 202. 1845; Mikrog. *pl. 35A. XXII. f. 12.* 1854.

Gallionella oculus Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 202. 1845.

Melosira oculus Kütz. Sp. Alg. 31. 1849. Pritch. Hist. Infus. ed. 4. 819. 1861.

Cyclotella radiata Bright. Quart. Journ. Micr. Sci. **8:** 96. *pl. 6. f. 11.* 1860.

Melosira radiata Grun. in Fenzl, Reise Novara Bot. **1:** 27. 1870.

Melosira (*sol* var.?) *polaris* Grun. Denkschr. Akad. Wien **48**^{2}**:** 95. *pl. 5. f. 33.* 1884.

Found at station 2844, off Alaska.

Melosira sulcata (Ehrenb.) Kütz. Bacill. 55. *pl. 2. f. 7.* 1844. Rabh. Fl. Eur. Alg. **1:** 42. 1864. Schmidt, Atlas *pl. 177. f. 23–39.* 1892. Wolle, Diat. N. A. *pl. 58. f. 13–14.* Truan & Witt, Diat. Hayti, 17. *pl. 4. f. 19. 20.* 1888. Van Heur. Synop. *pl. 91. f. 16–18. 22–24.* 1881. Pritch. Hist. Infus. ed. 4. 819. *pl. 9. f. 131, pl. 11. f. 26.* Jan. Abh. Schles. Ges. Vaterl. Cult. **1862**^{2}**:** 10. *pl. 1A. f. 22.* 1862. H. L. Smith, Sp. Diat. Typ. no. 233. 1874.

Gallionella sulcata Ehrenb. Ber. Akad. Wiss. Berl. **1837:** 61. 1838; Infus. 170. *pl. 21. f. 5.* 1838; Phys. Abh. Akad. Wiss. Berl. **1839:** 171. *pl. 3. f. 5a–e.* 1841; **1841:** 437. *pl. 1. I. f. 17.* 1843; Mikrog. *pl. 18. f. 1a–c, pl. 20. II. f. 27, pl. 25A. XVII. f. 11–12.* 1854.

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[a] Schmidt, Atlas, *pl. 176. f. 23.* 1892.

[b] Herib. Diat. Auverg. 32 *pl. 10. f. 31.* 1893.

[c] Schmidt, Atlas *pl. 176. f. 21.* 1892.

[d] Ehrenb. Mikrog. *pl. 35B. f. 9.* 1854.

[e] Pritch. Hist. Infus. ed. 4. 811. 1861.

[f] Ber. Akad. Wiss. Berl. **1854:** 239. 1855.

[g] W. Smith, Synop. Brit. Diat. **2:** 59. *pl. 52. f. 33.* 1856.

Orthosira marina W. Smith, Synop. Brit. Diat. **2:** 59. *pl. 53. f. 338.* 1856. Lewis, Proc. Acad. Phila. **1861:** 71. 1862.

Melosira marina Jan. Abh. Schles. Ges. Vaterl.-Cult. **1862**^{2}: 11. *pl. 1. A. f. 3-4.* 1862.

Paralia marina Heib. Krit. Overs. Danske Diat. 33. 1863.

Paralia sulcata Cleve, Bih. Sv. Vet. Akad. Handl. **1**^{13}: 7. 1873. De Toni, Syll. Alg. **2:** 1349. 1894. Schmidt, Atlas *pl. 175. f. 6-14, pl. 176. f. 11-20, 22, 24-26, 28-29, 32-37, 44-46.* 1892. Pant. Beitr. Bacill. Ung. **2:** 80. *pl. 18. f. 295, 297.* 1886. Grun. Denkschr. Akad. Wien **48**^{2}: 93. *pl. 5. f. 34* (?), *35-36.* 1884.

Orthosira sulcata O'Meara, Proc. Roy. Irish Acad. II. **2:** 252. 1875.

Found at stations 2823, 3694H, Gulf of California and Okhotsk Sea.

Melosira undulata (Ehrenb.) Kütz. Bacill. 54. *pl. 2. f. 9.* 1844. Van Heur. Synop. *pl. 90. f. 5-6, 8-9.* 1881. Pritch. Hist. Infus. ed. 4. 819. 1861. De Toni, Syll. Alg. **2:** 1339. 1894. Schmidt, Atlas *pl. 180. f. 1-21.* 1892. Wolle, Diat. N. A. *pl. 112. f. 4-5.* 1890. Pant. Beitr. Bacill. Ung. **3:** *pl. 3. f. 44, pl. 9. f. 146, 149.* 1893.

Gallionella undulata Ehrenb. Ber. Akad. Wiss. Berl. **1840:** 17. 1841; Mikrog. *pl. 12. f. 9a* (*pl. 15A. f. 8a-d?*). 1854.

Melosira punctigera Ralfs; Pritch. Hist. Infus. ed. 4. 819. 1861.

Gallionella punctigera Ehrenb. Ber. Akad. Wiss. Berl. **1842:** 339. 1843; Mikrog. *pl. 12. f. 9b-i, pl. 15B. f. 5.* 1854.

Melosira (*undulata* var.?) *normanii* Arnott: Van Heur. Synop. *pl. 90. f. 7.* 1881.

Melosira gowenii Schmidt, Atlas *pl. 176. f. 4-6* (name in *pl. 177*, footnote; see also *pl. 180. f. 21*, remark). 1892.

As De Toni indicates, it is questionable about including here *Gallionella punctata* Ehrenb.[a]

Found at stations 2680H and 2866, off central California and British Columbia.

PODOSIRA Ehrenb.

Podosira Ehrenb. Ber. Akad. Wiss. Berl. **1840:** 161. 1841; Phys. Abh. Akad. Wiss. Berl. **1839:** 158. 1841. Rabh. Fl. Eur. Alg. **1:** 7, 37. *f. 9.* 1864. Pritch. Hist. Infus. ed. 4. 817. 1861. De Toni, Syll. Alg. **2:** 1360. 1894. Van. Heur. Treat. Diat. 447. 1896. Kütz. Bacill. 52. 1844. Cleve & Grun. Sv. Vet. Akad. Handl. **17**^{2}: 115. 1880. Petit, Fonds de la Mer **3:** 172. 1877 (sub Hyalodiscus). Castr. Rep. Voy. Chall. Bot. **2:** 109. 1886. W. Smith, Synop. Brit. Diat. **2:** 52. 1856.

Cyclotella Kütz. Bacill. 50. *pl. 1. f. II, III.* 1844, in part.

Hyalodiscus Ehrenb. Ber. Akad. Wiss. Berl. **1845:** 78. 1846. Van Heur. Synop. 213. 1881; Treat. Diat. 448. *f. 173.* 1896. Pritch. Hist. Infus. ed. 4. 814. 1861. Petit, Fonds de la Mer **3:** 172. 1877. Cleve & Grun. Sv. Vet. Akad. Handl. **17**^{2}: 116. 1880. Castr. Rep. Voy. Chall. Bot. **2:** 139. 1886. De Toni, Syll. Alg. **2:** 1365. 1894.

Craspedodiscus Ehrenb. Mikrog. *pl. 35A, XXIII. f. 6; pl. 35B. f. 11.* 1854, in part.

Melosira C. Ag. in part; H. L. Smith, The Lens **1:** 87. 1872. Lagers. Bih. Sv. Vet. Akad. Handl. **3**^{18}: 9. *pl. 1. f. 1.* 1876.

Pyxidicula Ehrenb. in part; O'Meara, Journ. Linn. Soc. Bot. **15:** 58. *pl. 1. f. 9.* 1876.

Actinocyclus Ehrenb. in part; Grun.; Van Heur. Synop. *pl. 118. f. 5.* 1881.

Hyalodiscus and Podosira have become indistinguishable, and in uniting them it is preferable to retain the older name, both from its clear right of priority and the misleading meaning of Hyalodiscus, none of the species being hyaline. Many authors have recognized the unity of these forms. Castracane unites them, but under the later name, Hyalodiscus. H. L. Smith went so far as to unite both under Melosira

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[a] Phys. Abh. Akad. Wiss. Berl. **1870:** 56. 1871.

C. Ag. I agree with Castracane that this union is to be rejected. For, as he points out,[a] the present genus is never met with growing as Melosira invariably does—in long, solid, thread-like filaments. And although a few species of Melosira present a roughened center of the valve slightly resembling the "umbilicus" of Podosira, it is not characteristic of the genus, and where it does occur the blotch is insignificant, never shows a sutural line of separation from the rest of the valve—in short, is an altogether different thing. So that although individual valves of Melosira and Podosira may be found somewhat to resemble each other, the typical forms and the modes of growth are so widely different that their union would create much confusion and add unnecessarily to the already unwieldy bulk of Melosira. I think the only author following this plan of Smith's is Lagerstedt.

Kützing wished to merge Podosira in Cyclotella; but its generally larger size, more delicate structure, convex valves, and, above all, its prominent central umbilicus, make such a classification impossible.

Ralfs[b] distinguishes between Podosira and Hyalodiscus by stating that in the latter the valves are flat. This distinction is not true, and would not be important if it were. None of the species or varieties of Hyalodiscus are flat, though in some cases the convexity of the valve is slight. Both have the characteristic central umbilicus, bounded by an evident suture. Both show the same sort of markings, that of the umbilicus being blotched or rugose, that of the rest of the valve being delicate beading, generally arranged in curved lines, producing the appearance of "watch-case milling." Both grow in the same way, one or a few frustules joined by short, stout, gelatinous stipes. Some species previously classified as Podosira (or still so classified by anyone who runs the genus into Melosira) are wholly destitute of the before-mentioned umbilicus; but that it has been generally looked upon as an essential mark of Podosira is not only expressly stated by Ralfs, but evident from hundreds of figures of both Podosira and Hyalodiscus. Cleve & Grunow[c] get into the difficulty common with many authors of trying to distinguish between the two genera on the basis of the umbilicus. After having stated that "*Hyalodiscus* hat ein mehr oder weniger scharf abgesondertes Centrum," it is admitted that this is not universally so, as in varieties of *H. subtilis* Bail., "so dass sie sich in dieser Hinsicht gar nicht von manchen Formen der *Podosira maxima* unterscheiden!" In another place, after stating that Podosira may be looked upon as without an umbilicus, the writers add that in the case of *P. maxima* and *P. ambigua* "ein ganz entschiedener Umbilicus vorkommt." The whole discussion is a good illustration of the impossibility of holding these two genera separate. It is certainly well known to all who have examined gatherings rich in Podosira that in the same species and from the same locality the umbilicus varies greatly in size and distinctness, and individuals are not hard to find where scarcely a trace of it remains. Thus in the five species of Podosira given in the H. L. Smith type, four are with very strong umbilici; one, *P. montagnei* Kütz., a possible Melosira, without. In *P. hormoides* (Mont.) Kütz. the umbilicus is generally strong, in some cases quite small, and in at least a dozen valves on this single strewn slide almost impossible to see. Van Heurck[d] says: "The Hyalodiscus are not essentially different from Podosira, except in the umbilicus, which is more or less distinct according to species."

If, therefore, we remove from this genus the forms that evidently belong to other genera, chiefly Melosira and Coscinodiscus, we may define it as follows:

Frustules growing singly or in a series of a few members, attached to a support and to the next in the series by short, stout, gelatinous stipes, centrally placed, these usually causing a pronounced "umbilicus" or rugose scar situated in the center of

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[a] Castr. Rep. Voy. Chall. Bot. **2**: 139. 1886.

[b] Pritch. Hist. Infus. ed. 4. 814–815. 1881.

[c] Sv. Vet. Akad. Handl. 17^2: 115–116. 1880.

[d] Van Heur. Treat. Diat. 448. 1896.

of each valve; the umbilicus generally (not always) separated from the rest of the valve by an irregular line or suture; size of the umbilicus varying from a mere speck (rarely wanting) to two-thirds the diameter of the valve; valves slightly convex to hemispherical; markings, outside of the umbilicus, of delicate beading arranged in close straight or curved lines crossing each other obliquely to the radii; radial lines, continuous or discontinuous, sometimes proceeding from the umbilicus toward or to the border, in the latter case dividing the valve into unequal segments; border narrow, hyaline; connecting zone narrow, hyaline.

Podosira argus Grun. in Schneider, Beitr. Kennt. Kauk. 132. 1878; Jour. Roy. Micr. Soc. **2:** 691. *pl. 21. f. 6.* 1879. De Toni, Syll. Alg. **2:** 1364. 1894.

Podosira variegata Schmidt, Atlas *pl. 140. f. 3–6.* 1889. Wolle, Diat. N. A. *pl. 69. f. 3.* 1890.

Podosira pacifica Chase in Walk. & Chase, Notes on Diatoms **1:** 5. *pl. 1. f. 5.* 1886.

This exquisitely beautiful diatom is a wide departure from the type of this genus. The umbilicus is reduced to an indefinite scar, which is sometimes wanting. The valve is divided into three definite areas, like those of Cestodiscus, but without processes. It agrees in these particulars with the equally aberrant *Podosira* (*Pyxidicula*) *radiata* O'Meara.[a] Both these stand so much alone that they almost merit separation from this genus. It will, however, be observed that three authors independently assigned it to the present genus. There is also a close enough likeness to *Podosira corolla* Schmidt,[b] to give support to this identification.

The species is fairly abundant at station 2920H. I am quite sure that in all the specimens examined the massive bosses ornamenting the central area are not, as Schmidt claims, thickenings on both sides of the valve, but are on the under (concave) side only. The outer of the three bands is also different, being not hyaline but plainly crossed with two sets of lines, diagonal (45°) to the radii, as is common in this genus; within this is the band of fine radiating lines, as depicted by Schmidt.

Found at stations 2920H and 3008H, California to Hawaiian Islands.

Podosira stelliger (Bail.) Mann.

Hyalodiscus stelliger Bail. Smithson. Contr. Knowl. **7:** 10. 1854. Van Heur. Synop. 213. *pl. 84. f. 1, 2.* 1881; Treat. Diat. 448. *f. 173, pl. 22. f. 650.* 1896. De Toni, Syll. Alg. **2:** 1367. 1894. Pritch. Hist. Infus. ed. 4. 814. 1861. Grun. in Fenzl, Reise Novara Bot. **1:** 27. 1870. Cleve, Bih. Sv. Vet. Akad. Handl. **1**^{13}: 4. 1873.

Craspedodiscus? stella Ehrenb. Mikrog. *pl. 35B. IV. f. 11.* 1854; Ber. Akad. Wiss. Berl. **1854:** 238. 1855; Pritch. Hist. Infus. ed. 4. 939. 1861.

Podosira maculata W. Smith, Synop. Brit. Diat. **2:** 54. *pl. 49. f. 328.* 1856. Pritch. Hist. Infus. ed. 4. 815. 1861. Schmidt, Atlas *pl. 139. f. 7* (*f. 4?* unnamed). 1889.

Hyalodiscus stelliger Bail.; Fricke's Verzeich. 1902. H. L. Smith, Sp. Diat. Typ. no. 420. 1874. Schmidt, Jahresb. Komm. Deut. Meere **2:** *pl. 3. f. 26.* 1874. Wolle, Diat. N. A. *pl. 69. f. 4–5.* 1890 (figures poor).

Hyalodiscus maculatus Cleve, Bih. Sv. Vet. Akad. Handl. **1**^{13}: 4. 1873.

Melosira maculata Lagers. Bih. Sv. Vet. Akad. Handl. **3**^{15}: 9. *pl. 1. f. 1.* 1876.

The peculiar radiating lines of this species, dividing the disk, outside of the umbilicus into what Bailey calls "sectorial groups" and its relatively coarse beading define this species well. It, of course, grades somewhat into other species, being like all members of this genus variable. Its umbilicus is generally small. The Cleve & Möller type no. 1 bearing this name is very wide of the mark. It has practically no umbilicus but rather a ring, small and obscure, with radial interrupted dashes, like an Actinocyclus; in fact it differs from *Actinocyclus interpunctatus* (Bright.) Ralfs in little but the absence of a pseudonodule. O'Meara's description of this species[a] is deceptive and his figure is a mere caricature. The identity of *C. stella* Ehrenb. is unquestionable and is one of the few instances where Ehrenberg's diagnosis and illustration leave no doubt of the species. In this respect it differs markedly from a case to be mentioned under the next species. Both names were given in 1854. Bailey's was published in February and Ehrenberg's Mikrogeologie appeared somewhere between August 1, the date attached to his "Vorrede," and November 9, the date when he exhibited the first copy to the Berlin Academy.[b] Bailey's name is therefore the earlier one.

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[a] Journ. Linn. Soc. Bot. **15:** 58. *pl. 1. f. 9.* 1876.

[b] Schmidt, Atlas *pl. 140. f. 11, 12.* 1889.

Found at station 2807, Galapagos Islands.

Podosira subtilis (Bail.) Mann.

Hyalodiscus subtilis Bail. Smithson. Contr. Knowl. **7**: 10. *pl. 1. f. 12.* 1854. Schmidt, Atlas *pl. 139. f. 11, 15* (unnamed). 1889. W. Hendry, Quart. Journ. Micr. Sci. n. s. **2**: 179. fig. 1861. Pritch. Hist. Infus. ed. 4. 815. *pl. 5. f. 60.* 1861. Witt, Verh. Russ. Min. Gesell. II. **22**: 163. *pl. 7. f. 10.* 1886. Grun. in Fenzl, Reise Novara Bot. **1**: 27. 1870. H. L. Smith, Sp. Diat. Typ. no. 201. 1874. Jan. & Rabh. in Rabh. Beitr. 8. *pl. 1. f. 16.* 1863. Cleve & Grun. Sv. Vet. Akad. Handl. **17**^{2}: 116. 1880. De Toni, Syll. Alg. **2**: 1366. 1894. Castr. Rep. Voy. Chall. Bot. **2**: 140. *pl. 18. f. 4.* 1886. Petit, Trans. Roy. Micr. Soc. **1**: 239. 1878. H. L. Smith, Am. Journ. Micr. **3**: 247. 1878. Gr. & St. Journ. Quek. Micr. Club II. **3**: 67. 1887.

Hyalodiscus franklini in Cleve & Möll. type no. 2.

Craspedodiscus franklini Ehrenb. Ber. Akad. Wiss. Berl. **1853**: 526. 1854; Mikrog. *pl. 35A. XXIII. f. 6a, b.* 1854 ? not *Podosira franklini* Grun. 1878.

Melosira franklini Cleve, Bih. Sv. Vet. Akad. Handl. **25**: 216. 1868.

Whether or not Ehrenberg's *C. franklini* is identical with this can only be determined by knowledge based on a study of the original material collected by the expedition of Captain Penny in 1850 at Assistance Bay. That the diagnosis of Ehrenberg as well as his figure would suggest the above is certain; and many authors accept this without question. In that case the species would require a new name; but until certainty takes the place of conjecture Bailey's name should be undisturbed. A testimony adverse to looking on the two as the same is that of Petit,[c] who says that *P. franklini* "has very fine radiating striae, certainly invisible with the objectives used by Bailey twenty years ago." This may be so or not. One thing is evident, that Ehrenberg's figures of *C. franklini* are far more convex than they should be for *P. subtilis*. I have concluded that the two are probably the same, not certainly so; and I have accordingly placed Ehrenberg's name in the synonymy with a question mark.

Found at stations 2848, 3603, 3604, and 3607, Bering Sea.

STEPHANOPYXIS Ehrenb.

Stephanopyxis Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 264. 1845, as subg.; **1845**: 80. 1846. Char. Emend. Grun. Denkschr. Akad. Wien **48**^{2}: 34. 1884. Grev.; Greg. Trans. Roy. Soc. Edinb. **21**: 537. 1857. Pritch. Hist. Infus. ed. 4. 826. *pl. 5. f. 74–75.* 1861. Ehrenb. Mikrog. *pl. 18. f. 4, 6* (not *f. 7*); *pl. 19. f. 13.* 1854. Castr. Rep. Voy. Chall. Bot. **2**: 87. *pl. 9. f. 5. 9.* 1886. De Toni, Syll. Alg. **2**: 1137. 1894. Van Heur. Treat. Diat. 434. *f. 158.* 1896.

Systephania Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 264. 1845. Mikrog. *pl. 33. XV. f.* 22, *XVII. f. 16, XVIII. f. 11.* 1854. Kütz. Sp. Alg. 126. 1849. Castr. Rep. Voy. Chall. Bot. **2**: 150. *pl. 9. f. 11, pl. 30. f. 3* (not *f. 2*). 1886.

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[a] Proc. Roy. Irish Acad. II. **2**: 250. *pl. 26. f. 5a.* 1875.

[b] Ber. Akad. Wiss. Berl. **1854**: 629. 1855.

[c] Journ. Roy. Micr. Soc. **1**: 239. 1878.

Pyxidicula Ehrenb. in part; Ber. Akad. Wiss. Berl. **1844:** 264. 1845 (cf. Mikrog. *pl. 18. f. 6.* 1854.).

Dictyopyxis Ehrenb. in part; Ber. Akad. Wiss. Berl. **1844:** 262. 1845.

Coscinodiscus Ehrenb. in part; Mikrog. *pl. 38 B. XXII. f. 9.* 1854.

Creswellia Grev.; Greg. Trans. Roy. Soc. Edinb. **21:** 536. *pl. 14. f. 109.* 1857. Grev. Quart. Journ. Micr. Sci. **7:** 164. 1859.

Of the original genus Pyxidicula Ehrenb. no clear idea can be obtained, as Greville points out,[a] Ehrenberg's diagnosis[b] being equally applicable to any of a half dozen genera and his figures being beyond much question solitary frustules and valves of Gallionella Ehrenb.,[c] that is, of Melosira C. Ag. Indeed, he says in his diagnosis of Pyxidicula, "=Gallionella divisione spontanea perfecta aut nulla." The indefinite Pyxidicula was then divided into several genera and subgenera,[d] namely, Dictyopyxis to accommodate the forms with smooth cellular valves and Stephanopyxis for those with spinose cellular valves. The former was loosely formed and included evident examples of other genera, especially Melosira and Coscinodiscus, and, as the spines of Stephanopyxis are often obscure, perhaps even wanting, on single valves, members of Stephanopyxis would also fall into Dictyopyxis. Stephanopyxis includes in its diagnosis and figures the first consistent concept of these diatoms, and as elaborated by Grunow it is the genus to be preferred. Unfortunately, however, it was not published as a genus until 1846.[e] Systephania was published as a genus in 1845, and is truly identical, its first figures cited above being unmistakable examples of Stephanopyxis; but Systephania has never been taken up by the diatomists and until all diatomaceous genera have been typified there is no knowing but that there may be an older name. The above is, therefore, retained until it can be considered more critically. The diatom of Donkin's *Systephania anglica*[f] is excluded. As Grunow points out the present genus is very variable as between species, different individuals of one species, and even the two valves of one individual, it being not unusual for one valve to be deeper than the other, to show greater development of spines, etc. The confounding of specimens of the spurious genus Xanthiopyxis Ehrenb., with this genus has further complicated the subject.

Stephanopyxis appendicula Ehrenb. Mikrog. *pl. 18. f. 4.* 1854. Pritch. Hist. Infus. ed. 4. 826. 1861. Schmidt, Atlas *pl. 130. f. 18–26, 29, 31–32, 34–35.* 1886. Wolle, Diat. N. A. *pl. 62. f. 12–15.* 1890.

Pyxidicula appendicula Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 85, 264. 1845. Kütz. Sp. Alg. 22. 1849. Weisse, Mel. Biol. Acad. Sci. St. Petersb. **2:** 241. *pl. 1. f. 17.* 1855.

Pyxidicula hellenica Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 85. 1845.

Pyxidicula apiculata Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 85. 1845. Kütz. Sp. Alg. 22. 1849. Weisse, Mel. Biol. Acad. Sci. St. Petersb. **2:** 241. *pl. 1. f. 16.* 1855.

Stephanopyxis apiculata Ehrenb. Mikrog. *pl. 19. f. 13b.* 1854. Pritch. Hist. Infus. ed. 4. 826. 1861. De Toni, Syll. Alg. **2:** 1137. 1894. Grun. Denkschr. Akad. Wien **48**²: 86. 1884. Wolle, Diat. N. A. *pl. 62. f. 16.* 1890.

Dictyopyxis hellenica Ehrenb. Mikrog. *pl. 19. f. 13a.* 1854.

Creswellia turris Arnott; Greg. Trans. Roy. Soc. Edinb. **21:** 538. *pl. 14. f. 109.* 1857.

Stephanopyxis turris Ralfs in Pritch. Hist. Infus. ed. 4. 826. *pl. 5. f. 74.* 1861. Grun. Denkschr. Akad. Wien **48**²: 87, *pl. 5. f. 7–16* (*f. 18–21* doubtful; not *f. 22, 23, 25*). 1884. De Toni, Syll. Alg. **2:** 1138. 1894. Van Heur. Synop. *pl. 83ter. f. 12.*

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[a] Trans. Roy. Soc. Edinb. **21:** 537. 1857.

[b] Ehrenb. Infus. 165. *pl. 10. f. 1a–f.* 1838.

[c] Cf. Gallionella op. cit. *pl. 10. f. 2–7.*

[d] Ber. Akad. Wiss. Berl. **1844:** 262–264, 272. 1845.

[e] Op. cit. **1845:** 80. 1846.

[f] Quart. Journ. Micr. Sci. n. s. **1:** 12. *pl. 1. f. 14.* 1861.

1881. H. L. Smith, Sp. Diat. Typ. no. 507. 1874. Castr. Rep. Voy. Chall. Bot. **2**: 88. 1886. Schmidt, Atlas *pl. 130. f. 43.* 1888. Wolle, Diat. N. A. *pl. 62. f. 3*, *pl. 66. f. 3*, *4*.

Cresswellia minuta Grev. Trans. Micr. Soc. Lond. n. s. **13**: 4. *pl. 1. f. 13.* 1865. Moeb. Diat.-taf. *pl. 62. f. 13.* 1890.

Stephanopyxis niejahri Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872**: 214. *pl. 6. II. f. 2.* 1873.

Stephanopyxis cylindrica Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1873**: 214. *pl. 6. II. f. 1.* 1874.

Grunow considers *S. apiculata* Ehrenb. as separate because its spines are close to the center of the valve. De Toni also ranks it as separate. I think the distinction is a very weak one. The poor figures by Weisse of *P. apiculata* and *P. appendicula* are identical. *S. campanula* Castr.[a] differs from this species solely in the increasing fineness of the network as it approaches the margin; in this respect it agrees with *S.* (*Cresswellia*) *palmeriana* Grev.,[b] and especially its variety,[c] which, like Castracane's form, is not easily separated from the above.[d] *S.* (*Cresswellia*) *turgida* Grev.[e] is also too close for easy distinction. Greville's figure is probably too coarse; he claims the network is much finer than in *S. turris*, though the valves are considerably larger. Grunow[f] also holds them to be distinct and draws attention to the enlarged ends of the spines.

Greville repeatedly spells the name "Creswellia," but later "Cresswellia;" the latter is correct, so far as the English family name of Cresswell is concerned.

Found at stations 2844, 4029H, Aleutian Islands and Bering Sea.

Stephanopyxis corona (Ehrenb.) Grun.; Van Heur. Synop. *pl. 83ter. f. 10, 11.* 1881; Treat. Diat. 434. *f. 158.* 1896. Grun. Denkschr. Akad. Wien **48**^{2}: 38. 1884. Schmidt, Atlas *pl. 123. f. 10–17, 19–20, pl. 130. f. 13, 16–17, 36.* 1888. De Toni, Syll. Alg. **2**: 1142. 1894. Wolle, Diat. N. A. *pl. 62. f. 1. 6, pl. 67. f. 20.* 1890.

Systephania corona Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 272. 1845; Mikrog. *pl. 33. XV. f. 22, XVII. f. 16.* 1854. Griff. & Henf. Micr. Dict. ed. 4. *pl. 18. f. 57.* 1883. Pritch. Hist. Infus. ed. 4. 832. *pl. 5. f. 81.* 1861.

Systephania diadema Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 272. 1845; Mikrog. *pl. 33. XVIII. f. 11.* 1854. Griff. & Henf. Micr. Dict. ed. 4. *pl. 18. f. 58.* 1883. Pritch. Hist. Infus. ed. 4. 833. 1861. Kütz. Sp. Alg. 126. 1849.

Stephanopyxis diadema Ehrenb. Ber. Akad. Wiss. Berl. **1845**: 80. 1846. Pritch. Hist. Infus. ed. 4. 826. 1861.

Pyxidicula diadema Kütz. Sp. Alg. 21. 1849.

But one specimen was found, identical with that figured by Schmidt.[g]

Found at station 3696.

Stephanopyxis trisculpta Mann, sp. nov. PLATE XLV, FIGURE 6.

Valve hemispherical, covered with large hyaline regular bosses, giving an obscure appearance of hexagonal network; no circle of spines, but instead of these short knob-like processes interspersed somewhat irregularly among the bosses or beads; these processes almost wanting at the center, becoming frequent at one-half the radius and from there outward increasing and near the margin regularly filling all the interspaces between the bosses or beads; below this double-marked outer plate a second plate regularly dotted (or perforated?), the dotting appearing through the bosses and interspaces, giving a shadowy granular appearance to the whole valve; rim, or margin of juncture of the two valves, hyaline (not seen in the accompanying figure, being out of focus).

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[a] Castr. Rep. Voy. Chall. Bot. **2**: 88. *pl. 19. f. 14.* 1886.

[b] Trans. Micr. Soc. Lond. n. s. **13**: 2. *pl. 1. f. 9.* 1865.

[c] Schmidt, Atlas *pl. 130. f. 44.* 1888.

[d] Cf. Schmidt, Atlas *pl. 130. f. 43. 1888.*

[e] Quart. Journ. Micr. Sci. **7**: 165. *pl. 7. f. 14.* 1859.

[f] Denkschr. Akad. Wien **48**^{2}: 90. 1884.

[g] Schmidt, Atlas *pl. 130. f. 13.* 1888.

Diameter of valve, 0.078 mm.

I confess to some doubt in referring my form to this genus; though its resemblance makes me prefer to classify it here rather than accept the less advisable alternative of creating a new genus for it. The correctness of placing it here is rendered more probable by its near resemblance to *Stephanopyxis broschii* Grun.,[a] especially the last figure. My species differs from that of Grunow in everything except the secondary punctation; in the large number of knob-like processes, toward the margin filling all the interspaces, in the evident hyaline border, in the absence of "two to five spines remote from the center." Of Grunow's figure which most nearly resembles this species, namely, figure 30, he says: "Fig. 30. Form ohne Stacheln, fraglich hieher gehorend."

Type in the U. S. National Museum, No. 590119, from station 2807, Galapagos Islands, April 4, 1888; 812 fathoms, bottom of Globigerina ooze and coral mud.

COSCINODISCUS Ehrenb.

Coscinodiscus Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1838**: 128. 1840. Ratt. Proc. Roy. Soc. Edinb. **16**: 449. 1889. De Toni, Syll. Alg. **2**: 1200. 1894.
Symbolophora Ehrenb. in part; Ber. Akad. Wiss. Berl. **1844**: 205. 1845.
Endictya Ehrenb. Ber. Akad. Wiss. Berl. **1845**: 71. 1846?
Odontodiscus Ehrenb. Ber. Akad. Wiss. Berl. **1845**: 72. 1846.
Heterostephania Ehrenb. Mikrog. 15. *pl. 35A. XIII, B. f. 4, 5.* 1854.
Cestodiscus Grev. Trans. Micr. Soc. Lond. n. s. **13**: 48. *pl. 5. f. 8, 9.* 1865.
Cosmiodiscus Grev. Trans. Micr. Soc. Lond. n. s. **14**: 79. *pl. 8. f. 11-13.* 1866.
Stoschia Jan.; Van Heur. Synop. *pl. 128. f. 6.* note. 1881.
Janischia Grun.; Van Heur. Synop. *pl. 95. f. 10-11.* 1881.
Micropodiscus Grun. Denkschr. Akad. Wien **48**: 79. 1884.
Willemoesia Castr. Rep. Voy. Chall. Bot. **2**: 165. *pl. 8. f. 8, 8a, 8b.* 1886, no species.
Ethmodiscus Castr. Rep. Voy. Chall. Bot. **2**: 166. *pl. 3. f. 1, 9.* 1886.

The above condensation results in a genus of huge proportions, the type of the discoidal diatoms, as the genus Navicula is of the elongated forms. The general structure of its valves is, as the name indicates, a circle covered with a hexagonal network, a "sieve-disk." But the rather unwieldy dimensions of the genus is more than offset by the definiteness of type which it affords. The differences upon which the above synonyms were formed are none of them confined to the species that would be therein included, but grade off into other forms that are unmistakable examples of Coscinodiscus. One example will suffice, Cestodiscus Grev. Its generic character rests on the small submarginal processes that adorn the valves. But such processes, a little smaller, are the rule rather than the exception in Coscinodiscus, as for example in *C. subtilis* Ehrenb. Greville himself remarks: "I honestly confess that the best generic character I can frame is weak." The foregoing is equally applicable to Heterostephania Ehrenb. The most unsatisfactory member of the above combination to me is Endictya Ehrenb. The close resemblance of its members to the evident Coscinodiscus forms *C. robustus* Grev. and *C. marginatus* Ehrenb. is responsible for this union. But they are also close to some specimens of Stephanopyxis, and besides have certain peculiarities found in no other Coscinodiscus. The valves are not flat or convex disks, but cups; not bounded by a ring-like margin, but when viewed from the valval side, encircled by a somewhat raised and pointed edge from which the valves turn vertically downward to form a band, ornamented like the face of the valve with a rugged network; so that the two valves if placed together form, without the connecting girdle, a cylindrical pill box. In this they agree with Melosira, though differing from that genus in mode of growth. I have adopted here the generally admirable classification of Rattray, although in this and some other respects it seems open to criticism, a state of things probably inevitable under any arrangement.

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[a] Denkschr. Akad. Wien $\mathbf{48}^2$: 90. *pl. 5. f. 26-30.* 1884.

Some of the members of this genus approach, through their markings, Stictodiscus and Hemiptychus Ehrenb., and, through their processes, Tripodiscus Ehrenb.

Coscinodiscus africanus Jan. Diat. Gaz. Exped. *pl. 3. f. 2*, ined. Schmidt, Atlas *pl. 59. f. 24, 25*. De Toni, Syll. Alg. **2**: 1258. 1894. Ratt. Proc. Roy. Soc. Edinb. **16**: 534. 1889.

This remarkable form shows two sets of border markings; one of fine radial lines, i. e., perpendicular to the margin, the other of strong spirally and obliquely arranged markings, made very prominent in the above figure by Schmidt. I am convinced these latter are an optical illusion. They are caused by the fact that the actual border markings, the fine cross lines, do not lie parallel on the two surfaces of the border, the upper and under sides, belonging to the upper and under valves of the frustule. In other words, the two sets of lines cross each other at a very acute angle. This peculiarity is the result of the excentric arrangement of all the markings of the valve. The two foci are not directly above each other; and therefore the lines radiating from them, including the fine lines on the border, are not parallel. As a consequence the false spiral markings appear best under low powers of magnification or when slightly out of focus. Under a one-twelfth inch objective and with careful focusing they are not to be seen.

The curious excentric arrangement of the network and the spiral appearance of the border seem like an abnormality. But the species is very true to its type. My specimens come from the same locality as the original, the Galapagos Islands. They are another illustration of the value of the diatoms for indicating locality. Castracane's "var. *rotunda*" of this species,[a] though recognized by De Toni, has nothing to recommend such an assignment except the mere accident of an excentric arrangement of markings.

Found at station 2807, Galapagos Islands.

Coscinodiscus asteromphalus Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 77. 1845; Mikrog. *pl. 18. f. 45, pl. 33, X V. f.* 7. 1854. Pritch. Hist. Infus. ed. 4. 828. 1861. Grun. Denkschr. Akad. Wien **48**^{2}: 78. *pl. 3. f. 9*. 1884. Pant. Beitr. Bacill. Ung. **1**: 73. *pl. 17. f. 153*. 1886. Ratt. Proc. Roy. Soc. Edinb. **16**: 549. 1889. Schmidt, Atlas *pl. 63*. 12. 1878; *pl. 113. f. 22–23*. 1888. Cleve & Möll. type no. 57. 164. Jan. Diat. Gaz. Exped. *pl. 4. f. 9*. Van Heur. Synop. *pl. 128. f. 1–3, 5; pl. 130. f. 1–2, 5–6*. 1881. De Toni, Syll. Alg. **2**: 1268. 1894.

Coscinodiscus omphalanthus Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 266. 1845. Pritch. Hist. Infus. ed. 4. 828. 1861. Cleve & Möll. type no. 57, 215. H. L. Smith, Sp. Diat. Typ. no. 95 (not Schmidt, Atlas *pl. 63. f. 2*. 1878).

Coscinodiscus oculus-iridis Ehrenb.; Schmidt, Atlas *pl. 63. f. 5*. 1878.

Coscinodiscus centralis Ehrenb.; Schmidt, Atlas *pl. 63. f. 1*. 1878.

Rattray says, "This species is distinguished by the evident puncta on the markings." But many other species share this character, as *C. marginatus* Ehrenb. and *C. robustus* Grev. Ralfs says,[b] "It differs from the other species with stellate umbilicus by its minutely punctate cellules." These two distinctive characters should be taken together.

Found at stations 2929, 3570, 2287H, 3635H, 4023H, 4025H, off California to Bering Sea.

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[a] Castr. Rep. Voy. Chall. Bot. **2**: 159. *pl. 24. f. 3*. 1886.

[b] Pritch. Hist. Infus. ed. 4. 828. 1861.

Coscinodiscus borealis Bail. Amer. Journ. Sci. II. **22:** 3. 1856. Pritch. Hist. Infus. ed. 4. 838. 1861. H. L. Smith, Sp. Diat. Typ. no. 90, 93, 95. 1874. Ratt. Proc. Roy. Soc. Edinb. **16:** 558. 1889. Schmidt, Atlas. *pl. 63. f. 11.* 1878. De Toni, Syll. Alg. **2:** 1274. 1894.

Coscinodiscus oculus-iridis Ehrenb. var.; Cleve, in Nordensk. Vega Exped. **3:** 488. 1883. Grun. Denkschr. Akad. Wien **48**^{2}: 77. 1884.

Bailey says, "This resembles *C. oculus-iridis;* but the cellules forming the star are more rounded, and the other cellules are larger." Rattray says, "Distinguished from *C. oculus-iridis* by the coarser and more robust markings." The species is nevertheless of doubtful worth; and Cleve and Grunow have perhaps done rightly in classing it as a variety of *C. oculus-iridis.* Ehrenberg[a] gave the name to a quite different diatom, a variety of his *C. radiatus.*

Found at stations 2844, 3607, 3361H, Aleutian Islands and Bering Sea.

Coscinodiscus centralis Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1838:** 129. 1840 (?); Ber. Akad. Wiss. Berl. **1844:** 78. 1845; Mikrog. 18. *f. 39, pl. 22. f. 1.* (not *pl. 21. f. 3*). 1854. Pritch. Hist. Infus. ed. 4. 828. 1838. Greg. Trans. Roy. Soc. Edinb. **21:** 501. *pl. 11. f. 49.* 1857. Van Heur. Synop. *pl. 103. f. B.* 1881. H. L. Smith. Sp. Diat. Typ. no. 91, 92. 1874. Cleve & Möll. type no. 57, 164, 207, 215. Castr. Rep. Voy. Chall. Bot. **2:** 155. *pl. 2. f. 3.* 1886. Ratt. Proc. Roy. Soc. Edinb. **16:** 555. 1889. De Toni, Syll. Alg. **2:** 1272. 1894.

Coscinodiscus asteromphalus Ehrenb. var.; Grun. Denkschr. Akad. Wien **48**^{2}: 79. 1884.

This species is, like the two preceding ones, too close in some of its varieties to *C. oculus-iridis* Ehrenb. In fact, we have here to do with a group of forms that run into one another and render the specific boundaries unsusceptible of sharp definition.

A figure in Schmidt's Atlas [b] represents the more common variety in the following dredging.

Grunow does not recognize this as belonging to the present species; but I think with Schmidt it should be classed here.

Many figures of this species are worse than worthless, notably that by O'Meara.[c]

Found at Station 2807, Galapagos Islands.

Coscinodiscus cocconeiformis Schmidt, Atlas *pl. 58. f. 24–28.* 1878. Ratt. Proc. Roy. Soc. Edinb. **16:** 599. 1889. De Toni, Syll. Alg. **2:** 1302. 1894. Wolle, Diat. N. A. *pl. 94. f. 4, 5.* 1890.

The forms found in the following dredging are larger than those figured by Schmidt, and the dots radiate regularly from the elliptical center, a variation wider than the inconsequential ones shown in Schmidt's figures, to which Rattray gives three varietal names.

Found at station 2807, Galapagos Islands.

Coscinodiscus concavus (Ehrenb.) Greg. Trans. Roy. Soc. Edinb. **21:** 500. *pl. 10. f. 47.* 1857. Cleve, Bih. Sv. Vet. Akad. Handl. **1**^{11}: 4. 1873. Ehrenb. Phys. Abh. Akad. Wiss. Berlin **1841:** 412. 1843; Ber. Akad. Wiss. Berl. **1844:** 78. 1845 Mikrog. *pl. 21. f. 4* (not *pl. 18. f. 38*). 1854; Phys. Abh. Akad. Wiss. Berlin **1871:** 260. 1873. Schmidt, Atlas. *pl. 62. f. 8* (not *pl. 59. f. 16*). 1878. Kütz. Sp. Alg. 125. 1849. Ratt. Proc. Roy. Soc. Edinb. **16:** 469. 1889. De Toni, Syll. Alg. **2:** 1215. 1894.

Coscinodiscus concavus africae Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 79. 1845.

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[a] Ber. Akad. Wiss. Berlin **1861:** 294. 1862.

[b] Schmidt, Atlas *pl. 60. f. 12.* 1878.

[c] Proc. Roy. Irish Acad. II. **2:** *pl. 26. f. 19.* 1875.

Endictya oceanica Ehrenb. Ber. Akad. Wiss. Berl. **1845**: 76. 1846; Mikrog. *pl. 35A, XVIII. f. 6, 7.* 1854. Pritch. Hist. Infus. ed. 4. 831. *pl. 5. f. 70.* Cleve & Möll. type no. 110, 259. H. L. Smith, Sp. Diat. Typ. no. 148. 1874. Schmidt, Atlas *pl. 65. f. 10, 12, 13, 15.* 1881. De Toni, Syll. Alg. **2**: 1189. 1894.

Endictya minor Schmidt, Atlas *pl. 65. f. 14, 16.* 1881.

In this list Rattray also includes *Orthosira oceanica* Bright.,[a] which is synonymous with *Melosira oceanica* (Bright.) Leud-Fort.[b] To this I can not agree. Rattray does not take note of Brightwell's figure, which is so unquestionably a Melosira (Orthosira type) that it is impossible to classify it in this genus. It is true that Brightwell states his form may be the same as Gregory's above-cited figure of *C. concavus*. It is also true that the valval view resembles *Endyctia oceanica* Ehrenb. and *E. minor* Schmidt, classified by Rattray with this species and here admitted into the synonymy. But if they all are the same as Brightwell's form, then there is nothing to do but transfer them all to the genus Melosira. The same is true of *Melosira cribrosa* Breb.,[c] if we take Brebisson's statement of its zonal view and mode of growth, rather than that observed by Smith. I have, therefore, not included this in the above synonymy, though Rattray treated it as a synonym. There is no question about the forms found by me being Coscinodiscus; nor is there any reason to doubt that the similar specimens figured by Ehrenberg[d] and by Gregory[e] are also members of this genus. Ehrenberg's example is unfortunately abnormal; but that it stands for his *C. concavus*, rather than the quite different form previously figured,[f] is proved by the fact that in his summary of his genera and species[g] he refers to his figure in plate 21, but excludes that in plate 18. It may be added that the difficulty here brought out of placing the above Endictya forms with this species gives emphasis to the doubt expressed by me in discussing the present genus as to the union of Endictya with Coscinodiscus.

Found at station 2807, Galapagos Islands.

Coscinodoscus concinnus W. Smith, Synop. Brit. Diat. **2**: 85. 1856. Roper, Quart. Journ. Micr. Sci. **6**: 20. *pl. 3. f. 12.* 1858. Pritch. Hist. Infus. ed. 4. 828. *pl. 5. f. 89.* 1861. Jan. Diat. Gaz. Exped. *pl. 2. f. 6.* Schmidt, Atlas *pl. 114. f. 8, 9.* 1888. H. L. Smith, Am. Journ. Micr. **2**: 102. 1877. Cleve & Möll. types no. 215, 319. Ratt. Proc. Roy. Soc. Edinb. **16**: 531. 1889. De Toni, Syll. Alg. **2**: 1256. 1894. H. L. Smith, Sp. Diat. Typ. no. 92. 1874. Grun. Denkschr. Akad. Wien **48**^{2}: 79. 1884.

Coscinodiscus moseleyi O'Meara, Quart. Journ. Micr. Sci. n. s. **15**: 330. 1875; Journ. Linn. Soc. Bot. **16**: 57. *pl. 1. f. 6.* 1877. Castr. Rep. Voy. Chall. Bot. **2**: 153. 1886.

Coscinodiscus ? tenuis Bail. Bost. Journ. Nat. Hist. **7**: 333. *pl. 7. f. 9.* 1862.

Coscinodiscus centralis Schulze; Grun. Journ. Roy. Mic. Soc. **2**: 688. 1879. H. L. Smith, Sp. Diat. Typ. **92**: 1874, not Ehrenb. 1854.

Coscinodiscus papuanus Castr. Rep. Voy. Chall. Bot. **2**: 154. *pl. 3. f. 3.* 1886.

Coscinodiscus commutatus Grun. Denkschr. Akad. Wien **48**^{2}: 79. 1884.

Eupodiscus ? commutatus Grun. Denkschr. Akad. Wien **48**^{2}: 79. 1884.

Eupodiscus jonesianus Grev. Trans. Micr. Soc. Lond. n. s. **10**: 22. *pl. 2. f. 3.* 1862. Cleve, Bih. Sv. Vet. Akad. Handl. **1**^{11}: 5. 1873. H. L. Smith, Sp. Diat. Typ. no. 163. 1874. Moeb. Diat.-taf. *pl. 42. f.* 3. 1890.

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[a] Quart. Journ. Micr. Sci. **8**: 96. *pl. 6. f. 14 a–b.* 1860.

[b] Mem. Soc. Emul. St. Brieuc 72. 1879.

[c] Ann. Mag. Nat. Hist. II. **19**: 11. *pl. 2. f. 15.* 1857.

[d] Ehrenb. Mikrog. *pl. 21. f. 4.* 1854.

[e] Greg. Trans. Roy. Soc, Edinb. **21**: *pl. 10. f. 47.* 1857.

[f] Ehrenb. Mikrog. *pl. 18. f. 38.* 1854.

[g] Phys. Abh. Akad. Wiss. Berl., **1871**: 260. 1873.

This very delicate species is with some difficulty separated from *C. centralis* Ehrenb. W. Smith claims that its markings are so much finer that Ehrenberg could not have seen them with his microscope. This is indeed the difference. But it is a question if this offsets their close resemblance, in both having a central rosette of very large cells surrounded by unusually fine markings, in both having the two peculiar marginal processes which led Greville to class them as Eupodiscus, etc. The separation is at least open to question. Greville's beautiful figure of *E. jonesianus* is inaccurate, and Roper's figure emphasizes too strongly the radiating lines.

Found at stations 2807, 4516H, Galapagos Islands, and off Lower California.

Coscinodiscus curvatulus Grun.; Schmidt, Atlas *pl. 57. f. 30, 33–37.* 1878; *pl. 113. f. 6.* 1888. Grun. Denkschr. Akad. Wien **48**^{2}: 83. *pl. 4 D. f. 8–16.* 1884. Jan. Diat. Gaz. Exped. *pl. 2. f. 7, pl. 5. f. 2, 3, 8, pl. 6. f. 2, pl. 20. f. 17.* Cleve & Möll. types no. 57, 154, 162, 164, 276, 319. Ratt. Proc. Roy. Soc. Edinb. **16**: 486. 1889. De Toni, Syll. Alg. **2**: 1226. 1894.

Coscinodiscus (*Odontodiscus*) *curvatulus* Grun.; Cleve & Grun. Sv. Vet. Akad. Handl. **17**^{2}: 113. *pl. 7. f. 129.* 1880. Cleve in Nordensk. Vega Exped. **3**: 488. 1883.

Coscinodiscus szontaghii Pant. Beitr. Bacill. Ung. **1**: 74. *pl. 15. f. 133, pl. 28. f. 278.* 1886.

In my specimens the curvature of the fascicles is so slight as to be easily overlooked, a characteristic which, though emphasized in the name, is unimportant and variable. There can be no doubt that this form and *Actinocyclus curvatulus* Jan.[a] are the same diatom except for the accident of a pseudonodule in the latter. I do not regard the figures by Janisch [b] as belonging here, though Rattray so classifies them. His reference to H. L. Smith type no. 99 as containing this species under the name of *Odontodiscus curvatulus* Grun. is wrong, so far as the slide I have is concerned. It comes from Japan and is marked *C. scintillans* Grev., and although it shows abundant examples of *C. subtilis* Ehrenb., which has some slight resemblance to this species, it is a quite distinct form, as Rattray points out. It is probable that Rattray's slide of Smith's no. 99 shows this species; but the reference is faulty as a general reference. Pantocsek's figures of *C. szontaghii* are so utterly different from this species that they are worse than useless. By reading his description it is, however, plain that Rattray is correct in uniting this form with the above. It would be well for diatomists to either forego the luxury of illustrations or make them near enough like the objects in nature to be capable of recognition.

Found at stations 3604, 4022H, Bering Sea.

Coscinodiscus decrescens Grun.; Schmidt, Atlas *pl. 61. f. 8–10, 15.* 1878. Grun. Denkschr. Akad. Wien **48**^{2}: 80. *pl. 3. C. f. 11, 18.* 1884. Ratt. Proc. Roy. Soc. Edinb. **16**: 525. 1889. De Toni, Syll. Alg. **2**: 1252. 1894.

Rattray, followed by De Toni, includes in the above *C. heteroporus* Ehrenb.[c] and *C. argus* Grun.[d] I think the assignment in Schmidt is much better. Rattray places a question mark after Schmidt's plate 61, figure 10, which, if an example of this species, must certainly be looked on as abnormal. Castracane has assigned this name to a totally different diatom,[e] for which Rattray proposes the name *C. minuens*.

Found at station 3361H, Bering Sea.

Coscinodiscus deformatus Mann, sp. nov. PLATE XLVIII, FIGURES 1, 2.

Valves nearly flat for four-fifths of the radius, thence curving slightly downward; network radially arranged, somewhat irregular at the center, but with no umbilicus;

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[a] Cf. Schmidt's figures above with his *pl. 57. f. 31.*

[b] Jan. Diat. Gaz. Exped. *pl. 1. f. 6, pl. 4. f. 4.*

[c] Schmidt, Atlas *pl. 61. f. 6–7.* 1878.

[d] Schmidt, Atlas *pl. 113. f. 7.* 1888.

[e] Castr. Rep. Voy. Chall. Bot. **2**: 159. *pl. 12. f. 14.* 1886.

the cells not small, but with very delicate walls; nearly uniform in size until within one-fifth of the radius from the margin, then rapidly decreasing to the margin; no dots or puncta within the hexagons; interradial lines frequent toward the margin; border a thin hyaline band; outline uniformly irregular by depression of one side.

Diameter of valve from 0.138×0.109 mm. to 0.080×0.071 mm.

Type in the U. S. National Museum, No. 590120, from station 2807, Galapagos Islands, April 4, 1888; 812 fathoms, bottom of Globigerina ooze and coral mud; collected also at station 3013H, Hawaiian Islands.

This form is not to be confused with the irregular, generally subtriangular examples of *C. heteroporus* Ehrenb., classed as *C. decrescens irregularis* Grun.[a] The far greater delicacy of the network, the absence of papillae, and the uniformity in the hexagons over the greater part of the valve, clearly distinguishing them. It is very abundant at both the above stations, the first of which is close to the Galapagos Islands and the second close to the Hawaiian Islands. This unusual form must therefore be looked upon as a subtropical littoral species.

Coscinodiscus denarius Schmidt, Atlas *pl. 57. f. 19–22.* 1878. Ratt. Proc. Roy. Soc. Edinb. **16**: 504. 1889. De Toni, Syll. Alg. **2**: 1238. 1894.

Coscinodiscus variolatus Castr. Rep. Voy. Chall. Bot. **2**: 155. *pl. 2. f. 5.* 1886.

It is doubtful if this has sufficient specific difference from *C. symmetricus* Grev. to warrant the above name. It is certainly not sufficiently different from the figures so named by Schmidt.[b] Compare also Greville's original figure.[c]

Found at station 3097, off central California.

Coscinodiscus elegans Grev. Trans. Micr. Soc. Lond. n. s. **14**: 3. *pl. 1. f. 6.* 1866. Schmidt, Atlas *pl. 58. f. 7*, *pl. 163. f. 10.* 1878. Pant. Beitr. Bacill. Ung. **1**: 73. *pl. 16. f. 141* (?), *pl. 24. f. 216.* 1886. Jan. Diat. Gaz. Exped. *pl. 4. f. 6.* Cleve & Möll. type no. 164. Truan & Witt, Diat. Hayti 14. *pl. 2. f. 22.* 1888. Ratt. Proc. Roy. Soc. Edinb. **16**: 585. 1889. De Toni, Syll. Alg. **2**: 1293. 1894. Moeb. Diat.-taf. *pl. 70. f. 6.* 1890.

Coscinodiscus margaritaceus Castr. Rep. Voy. Chall. Bot. **2**: 164. *pl. 18. f. 3.* 1886.

Of the above figures the first of Pantocsek's is worthless; those in Janisch and in Luard & Witt must be looked upon as representing extreme varieties.

In the specimen accompanying this report the frustule has two valves quite different in the arrangement of the beading, a good commentary on the constantly repeated absurdity of making "new species" out of such trifles.

Found at station 3604H, Bering Sea.

Coscinodiscus excentricus Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1839**: 146. 1841; **1841**: 323. *pl. 3. VII. f. 5.* 1843; Mikrog. *pl. 18. f. 32*, *pl. 21. f. 6.* W. Smith, Synop. Brit. Diat. **1**: 23. *pl. 3. f. 38.* 1853. Schmidt, Atlas *pl. 58. f. 46–49;* Jahresb. Komm. Deut. Meere **2**: *pl. 3. f. 36–38.* 1874. Grun. Denkschr. Akad. Wien **48**^{2}: 84. *pl. 4D. f. 7.* 1884. Van Heur. Synop. 217. *pl. 130. f. 4, 7, 8.* 1881. Jan. Diat. Gaz. Exped. *pl. 2. f. 3, pl. 6. f. 3, 7–11.* H. L. Smith, Sp. Diat. Typ. no. 93. 1874. Van Heur. Typ. Diat. Belg. no. 529, 530. Cleve & Möll. type no. 148, 150, 183, 207, 210, 211, 215, 228, 257, 258, 276. Ratt. Proc. Roy. Soc. Edinb. **16**: 461. 1889. De Toni, Syll. Alg. **2**: 1210. 1894.

Odontodiscus excentricus Ehrenb. Ber. Akad. Wiss. Berl. **1845**: 79. 1846. Schmidt, Jahresb. Komm. Deut. Meere **2**: 94. 1874.

Eupodiscus excentricus O'Meara, Quart. Journ. Micr. Sci. **7**: 245. *pl. 7. f. 2.* 1867. Moeb. Diat.-taf. *pl. 77. f. 2.* 1890.

Coscinodiscus minor Schmidt, Atlas *pl. 113. f. 9.* 1888.

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[a] Schmidt, Atlas *pl. 61. f.* 7. 1878.

[b] Op. cit. *pl. 57. f. 25–27.*

[c] Trans. Micr. Soc. Lond. n. s. **9**: 68. *pl. 8. f. 2.* 1861.

Coscinodiscus labyrinthus Roper, Quart. Journ. Micr. Sci. **6:** 21. *pl. 3. f*
Moeb. Diat.-taf. *pl. 19. f. 2 a–b.* 1890. Pritch. Hist. Infus. ed. 4.
Proc. Roy. Soc. Edinb. **16:** 471. 1889. Cleve & Möll. type no. 27
Syll. Alg. **2:** 1215. 1894. Grun. Denkschr. Akad. Wien[a] **48^2:** 73. 1

As the central portion of *C. sol* Wallich and this species are almost id
as the outer border is weakly silicified and easily destroyed, specimen
may easily be confused. It may ultimately be found that the two are
varieties of the same species, in which case O'Meara's *E. excentricus* wou
an intermediate form. Comparing it with the second figure of *C. sol*, whe
ing ring is greatly reduced, it is easy to see how an extension of the
lines in the otherwise hyaline border of O'Meara's form, and a reduction i
of silica would give us *C. sol*. Variation in these respects is by no mea
An analogous case will be found described under *C. robustus* Grev., wh
cases a massive investing ring is present, no trace of which is to found in m
of that species. There is, however, at this time no justification for
identity of *C. excentricus* and *C. sol*.

The variety called *C. labyrinthus* by Roper occurs at station 4505H.
symmetrical grouping of the hexagons that gives a strongly dotted appea
valve is obscure when mounted in Canada balsam, but very striking in t
mens. Finding this in connection with large quantities of *C. excentr*
been able to establish beyond question that this is simply a variety of th
is given separate rank by Ralfs, Schmidt, Rattray, and De Toni. It sh
stated that Schmidt's plate 59, figure 14, has nothing to do with the ab

Found at stations 2807, 2844, 2859, 3091, 3361H, 2604H, 3693H, 36
4023H, 4025H, 4505H, Galapagos Islands, off Kamchatka, south of Alaska
Bering Sea, off California, and Okhotsk Sea.

Coscinodiscus galapagensis Ratt. Proc. Roy. Soc. Edinb. **16:** 574. *pl. 2*
De Toni, Syll. Alg. **2:** 1285. 1894.

Coscinodiscus griseus galapagensis Grun.; Van Heur. Synop. *pl. 128.*
f. 1. 1881.

Coscinodiscus griseus Grev.; Schmidt, Atlas *pl. 58. f. 1.* 1878.

Coscinodiscus scintillans Grev.; Schmidt, Jahresb. Komm. Deut. Mee
f. 33. 1874 (?).

Coscinodiscus appolinis compacta Ratt. Proc. Roy. Soc. Edinb. **16:** 5

I think Rattray is correct in making this a new species rather than
C. griseus Grev. Greville's species[b] is quite different. I also think th
above as *C. scintillans* Grev. (?), which Rattray makes subspecies *co*
appolinis Ehrenb., is the same diatom. Indeed, the only doubt of the
Rattray's species is its closeness to forms of *C. scintillans* Grev. (*C. appoli*
as represented in this figure of Schmidt's, rather than to forms of *C. gris*

Found at station 2808, Galapagos Islands.

Coscinodiscus heteroporus Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 265. 1
Hist. Infus. ed. 4. 831. 1861. Grun. Denkschr. Akad. Wien **48**
Schmidt, Atlas *pl. 61. f. 1, 4, 6* (7?). 1878. Ratt. Proc. Roy. Soc.
540. 1889. De Toni, Syll. Alg. **2:** 1262. 1894.

Rattray refers Schmidt's figure[c] to *C. decrescens* Grun. As stated under
I think Schmidt is correct in assigning it here. Figure 7 is doubtful.

Found at station 3569H, Pribilof and Commander Islands.

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[a] Cf. Trans. Micr. Soc. Lond. n. s. **8:** 38. *pl. 2. f. 1–2.* 1860.

[b] Quart. Journ. Micr. Sci. n. s. **3:** 230. *pl. 9. f. 7.* 1863. Moeb. Diat.-ta
1890.

[c] Schmidt, Atlas *pl. 61. f. 6.*

Coscinodiscus lentiginosus Jan.; Schmidt, Atlas *pl. 58. f. 11.* 1878; Diat. Gaz. Exped. *pl. 4. f. 1–2, pl. 5. f. 7.* Grun. Denkschr. Akad. Wien **48**^{2}: 81. 1884. Ratt. Proc. Roy. Soc. Edinb. **16:** 491. 1889. De Toni, Syll. Alg. **2:** 1230. 1894.

The extreme delicacy of the markings, slightly excentric in arrangement, and the obscurity of the minute spine just within the margin, which are the distinguishing characters of this species, makes identification difficult. Castracane's form bearing this name[a], seems to lack these marks, and shows nothing to warrant its assignment here.

Found at station 3513, Bering Sea.

Coscinodiscus lineatus Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1838:** 129. 1840; **1841:** 371. *pl. 3. VII. f. 7, 8* (not *pl. 1. III. f. 20*). 1843; Mikrog. *pl. 18. f. 33, pl. 22. f. 6 a–b, pl. 35A. XVI. f. 3, pl. 35A. XVII. f. 7.* 1854. Kütz. Bacill. 131. *pl. 1. f. 10.* 1844. Pritch. Hist. Infus. ed. 4. 830. 1861. O'Meara, Proc. Roy. Irish Acad. II. **2:** 264. 1875. Van Heur. Synop. 217. *pl. 131. f. 3.* 1881. Jan. Diat. Gaz. Exped. *pl. 4. f. 8, pl. 20. f. 14.* Schmidt, Atlas *pl. 59. f. 26–32.* 1878; *pl. 114. f. 13.* 1888. Cleve & Möll. types no. 57, 114, 148, 150, 162, 207, 276. Ratt. Proc. Roy. Soc. Edinb. **16:** 472. 1889. De Toni, Syll. Alg. **2:** 1216. 1894. Wolle, Diat. N. A. *pl. 87. f. 10.* 1890.

Coscinodiscus ehrenbergii O'Meara, Proc. Roy. Irish Acad. II. **2:** 264. *pl. 26. f. 24.* 1875.

Two specimens mounted on one slide, accompanying this report, show how unimportant the marginal spines in this species are, one having very large spines and the other barely a trace of them. The single "pseudo-process" is present but inconspicuous in both.

A figure of Ehrenberg's[b] frequently included here is clearly that author's *C. excentricus*, and in his index to the plates[c] he gives this figure as "*Coscinodiscus lineatus? an eccentricus?*"

Found at stations 2680H, 2807, off California and Galapagos Islands.

Coscinodiscus marginatus Ehrenb. variety (?) PLATE XLIX, FIGURE 2.

Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 142. 1843; Mikrog. *pl. 18. f. 44, pl. 33. XII. f. 13, pl. 38B, XXII. f. 8.* 1854. Cleve & Möll. types no. 114, 164, 215. Schmidt. Atlas *pl. 62. f. 1–5, 9, 11, 12.* 1878. H. L. Smith, Sp. Diat. Typ. no. 94, 95. 1874. Ratt. Proc. Roy. Soc. Edinb. **16:** 509. 1889. De Toni, Syll. Alg. **2:** 1241. 1894 (not *C. marginatus* Ehrenb.; Kütz. Bacill. 131. *pl. 1. f. 7.* 1844; not *C. marginatus* Ehrenb.; Jan. Abh. Schles. Ges. Vaterl. Cult. **1862**^{2}: 3. *pl. 1A. f. 20.* 1862).

Coscinodiscus fimbriatus-limbatus Ehrenb.; Mikrog. *pl. 19. f. 4.* 1854. Schmidt, Atlas *pl. 65. f. 3–6.* 1881; *pl. 113. f. 2.* 1888.

Coscinodiscus limbatus Ehrenb.[d] Ber. Akad. Wiss. Berl. **1840:** 206. 1841; Mikrog. *pl. 20. f. 29 a.* 1854. Schmidt, Atlas *pl. 65. f. 7.* 1881.

Coscinodiscus radiatus forma *heterosticta* Grun.; Pant. Beitr. Bacill. Ung. **1:** 70. *pl. 20. f. 184.* 1886.

Coscinodiscus radiatus subaequalis forma *parva* Pant. Beitr. Bacill. Ung. **1:** *pl. 22. f. 203.* 1886.

Coscinodiscus robustus Grev.; Schmidt, Atlas *pl. 62. f. 6.* 1878.

Coscinodiscus robustus intermedia Grun. Denkschr. Akad. Wien **48**^{2}: 72. 1884.

Coscinodiscus subconcavus forma *major* Schmidt, Atlas *pl. 62, f. 7.* 1878.

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[a] Castr. Rep. Voy. Chall. Bot. **2:** 160. *pl. 5. f. 4.* 1886.

[b] Phys. Abh. Akad. Wiss. Berlin **1841:** *pl. 1. III. f. 20.* 1843.

[c] Op. cit. 438.

[d] This name as used by Grun. Denkschr. Akad. Wien **48**^{2}: 72. 1884 = *C. fimbriatus* Schmidt.

I have here figured a form common in several dredgings, which, according to present interpretations, passes under the above name. I do this in order to illustrate a confusion in the taxonomy of this species that should receive attention. Anyone who will compare Greville's original figure of *C. robustus*[a] with the original figure of Ehrenberg's *C. marginatus*[b] will see little resemblance between them. Yet Grunow, Schmidt, Pantocsek, Rattray, and others give no satisfactory marks of distinction, and we have all sorts of discordant opinions connected with most of the modern figures. Grunow gives us, on the one hand, a *C. robustus intermedia* Grun.[c] which Rattray makes *C. marginatus intermedia* Ratt.,[d] and on the other hand Grunow gives a *C. marginatus submarginata* Grun.,[e] which Rattray puts under *C. robustus* Grev.[e] Rattray further states that though the original slide of Greville's *C. robustus* is not available, two slides marked by him (Greville) "*C. robustus*" now in the British Museum are *C. marginatus* Ehrenb. In view of the foregoing facts I offer the suggestion that some one who has access to the material sift out these forms, and, if necessary, drop Greville's species entirely in favor of Ehrenberg's. The name *C. marginatus* might necessarily be retained, instead of the earlier *C. limbatus*, because of the uncertainty of the two figures Ehrenberg gives for that species.[f] Under present conditions no such thing as a positive identification is possible. I have labeled some specimens that show a narrow border and an absence of radial arrangement, with obscure or broad papillae in the hexagons, *C. robustus* Grev., and others, with broad and massive borders, somewhat radial and slightly diminishing areolation showing pronounced papillae, *C. marginatus* Ehrenb.; but though the best possible under the present circumstances, these can not be looked upon as critical identifications.

Diameter of valve here figured, 0.176 mm.

Found at stations 3361H, 3712H, off Panama and Okhotsk Sea.

Coscinodiscus nitidulus Grun.; Schmidt, Atlas *pl. 58. f. 20–21.* 1878 (not *pl. 113. f. 18.* 1888). Van Heur. Synop. *pl. 132. f. 2.* 1881. Pant. Beitr. Bacill. Ung. **1:** 73. *pl. 24. f. 214.* 1886. Ratt. Proc. Roy. Soc. Edinb. **16:** 480. 1889. De Toni, Syll. Alg. **2:** 1222. 1894. Jan. Diat. Gaz. Exped. *pl. 5, f. 13.*

Found at station 4516H, off Lower California.

Coscinodiscus nitidus Greg. Trans. Roy. Soc. Edinb. **21:** 499. *pl. 19. f. 45.* 1856. Schmidt, Atlas *pl. 58. f. 16-19.* 1878; Jahresb. Komm. Deut. Meere **2:** 94. *pl. 3. f. 32.* 1874. Pritch. Hist. Infus. ed. 4. 831. *pl. 8. f. 18.* 1861. Jan. Diat. Gaz. Exped. *pl. 5. f. 12, 14-16* (not *f. 13*). Pant. Beitr. Bacill. Ung. **1:** 75. *pl. 18. f. 166.* Van Heur. Synop. Suppl. *pl. C. f. 41.* 1885. Wolle, Diat. N. A. *pl. 94. f. 22-23.* 1890. Ratt. Proc. Roy. Soc. Edinb. **16:** 478. *pl. 1. f. 21.* 1889? De Toni, Syll. Alg. **2:** 1221. Cleve & Möll. type no. 150, 155, 208, 210, 257, 311.

Coscinodiscus foraminosus Grev. MS. in Coll. Brit. Mus.

This and the former species show considerable resemblance to certain members of the genus Stictodiscus.[g]

Found at station 2807, Galapagos Islands.

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[a] Trans. Micr. Soc. Lond. n. s. **14:** *pl. 1. f. 8.* 1866.

[b] Ehrenb. Mikrog. *pl. 18. f. 44.* 1854.

[c] Denkschr. Akad. Wien **48**^{2}**:** 72. 1884.

[d] Proc. Roy. Soc. Edinb. **16:** 511. 1889.

[e] Op. cit. 512.

[f] Ehrenb. Mikrog. *pl. 20. f. 29a-b.* 1854.

[g] Cf. Schmidt, Atlas *pl. 202. f. 4.* 1896 and Journ. Quek. Micr. Club II. **3:** *pl. 5. f.* 7. 1887.

Coscinodiscus nobilis Grun. Journ. Roy. Micr. Soc. **2**: 687. *pl. 21. f. 1.* 1879. Jan. Diat. Gaz. Exped. *pl. 6. f. 13*, *pl. 2. f. 6*, unnamed.[a] De Toni, Syll. Alg. **2**: 1266. 1894. Ratt. Proc. Roy. Soc. Edinb. **16**: 545. 1889.

Coscinodiscus regius Wall. in Schneider, Beitr. Kennt. Kauk. 27. 1878, Journ. Roy. Micr. Soc. **2**: 687. 1879.

This large and extremely delicate species is close to *C. fulguralis* Brun,[b] and to *C. diorama* Schmidt;[c] the chief mark of distinction being the far more rapid increase of the areolation from the center outward, and the consequently more robust size of the network in the last-named forms.

Found at stations 2882, 2919, 2923, 2929, 3346, 3712H, 4014H, off Oregon, southern California, Washington, Okhotsk Sea, and Honshu Island, Japan.

Coscinodiscus nodulifer Schmidt, Atlas *pl. 59. f. 20–23.* 1878. Jan. Diat. Gaz. Exped. *pl. 2. f. 4–5.* Wolle, Diat. N. A. *pl. 94. f. 7.* 1890. Ratt. Proc. Roy. Soc. Edinb. **16**: 520. 1889. De Toni, Syll. Alg. **2**: 1249. 1894. Cleve & Möll. type no. 57, 155.

Coscinodiscus radiatus Ehrenb. err. det. H. L. Smith, Sp. Diat. Typ. no. 98. 1874.

Rattray erroneously credits the name to Janisch. In both the first and second edition of Schmidt's Atlas it is credited to Schmidt, as well as in the note of Rattray's in his revision of the genus,[a] containing a list of the identifications by Janisch of his plates of the Gazelle Expedition.

Found at stations 2690H, 2807, 2916H, 2917H, 2920H, 3013H, off California, Galapagos Islands, to Hawaiian Islands.

Coscinodiscus normanni Greg.; Grev. Quart. Journ. Micr. Sci. **7**: 80. *pl. 6. f. 3.* 1859. Moeb. Diat.-taf. *pl. 20. f. 3.* 1890. Ratt. Proc. Roy. Soc. Edinb. **16**: 500. 1889. De Toni, Syll. Alg. **2**: 1235. 1894.

Coscinodiscus normannicus Greg.; Van Heur. Synop. *pl. 131. f. 1.* 1881; type no. 532.

Odontodiscus subtilis Grun.; Schmidt, Jahresb. Komm. Deut. Meere **2**: 95. 1874. Van Heur. Synop. 218. 1885.

Coscinodiscus subtilis Ehrenb.; Eulen. Diat. Sp. Typ. no. 115 (cf. Van Heur. Synop. 218. *pl. 131. f. 1.* 1881–85).

Coscinodiscus curvatulus Grun. var.; Cleve, in Nordensk. Vega Exped. **3**: 488. 1883.

Coscinodiscus fasciculatus Schmidt, Jahresb. Komm. Deut. Meere, **2**: 95. *pl. 3. f. 41.* 1874; Atlas *pl. 57. f. 9, 10.* 1878.

My specimens are with very obscure apiculae or wholly without them, a condition noted by Rattray. The specimen from station 3669H is placed here with some doubt. The beads are slightly oval. It is nearest to the unnamed figure,[d] on which Schmidt[e] has given reasons for withholding from this species. Rattray erroneously refers a figure[f] to this species to which Janisch gives the name *C. atlanticus* Grun.,[g] which should probably be *C. atlanticus* Castr. as figured in the subspecies,[h] a form recognized as valid by Rattray.

Found at stations 2844, 3526, 3571H, 3607, 3669H, Aleutian Islands, Bering Sea, Pribilof and Commander Islands, and along Kuril Chain.

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[a] Cf. Proc. Roy. Soc. Edinb. **16**: 462. 1889.

[b] Mem. Soc. Phys. et Hist. Nat. Geneva **31**^{1}: 21. *pl. 21. f. 6.* 1891.

[c] Schmidt, Atlas *pl. 64. f. 2.* 1878.

[d] Schmidt, Jahresb. Komm. Deut. Meere **2**: *pl. 3. f. 42.* 1874.

[e] Op. cit. 95.

[f] Jan. Diat. Gaz. Exped. *pl. 5. f. 6.*

[g] Proc. Roy. Soc. Edinb. **16**: 462. 1889.

[h] Castr. Rep. Voy. Chall. Bot. **2**: *pl. 3. f. 7.* 1886.

Coscinodiscus obscurus Schmidt, Atlas *pl. 61. f. 16–18.* 1878. Grun. Denkschr. Akad. Wien **48**^{2}: 74. 1884. Ratt. Proc. Roy. Soc. Edinb. **16**: 513. 1889. De Toni, Syll. Alg. **2**: 1244. 1894.

Cestodiscus obscurus Van Heur. Synop. *pl. 129. f. 4.* 1881.

The general cell structure of my specimens agrees well with the above, and the characteristic minute beads at the inner ends of the semiradial lines are very evident. They do not appear in the somewhat doubtful photograph of this diatom by Doctor Woodward.[a] The specimen from Sendai, Japan, called by Brun *C. obscurus floralis*,[b] can hardly be classed here; the fine beaded secondary markings in the hexagons and the absence of a striated border mark them as distinct. Brun's form is, except for the coarser marking, nearer to *C. floridulus* Schmidt, which, like the above, has minute beads at the terminations of the semiradial lines.

Found at station 2844, south of Alaska.

Coscinodiscus oculus-iridis Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1839**: 147. 1841; Mikrog. *pl. 18. f. 42, pl. 19. f. 2.* 1854. Jan. Abh. Schles. Ges. Vaterl. Cult. **1862**^{2}: 3. *pl. 1B. f. 6, pl. 2A. f. 4.* 1862. Schmidt, Atlas *pl. 63. f. 4* (no name), *6–9.* 1878; *pl. 113. f. 1, 3–5, 20.* 1888. Grun. Denkschr. Akad. Wien **48**^{2}: 77. 1884. Jan. Diat. Gaz. Exped. *pl. 2. f. 2.* Cleve & Möll. type no. 3, 57, 162, 215, 258, 259, 276, 319. Ratt. Proc. Roy. Soc. Edinb. **16**: 559. 1889. Pritch. Hist. Infus. ed. 4. 828. 1861. De Toni, Syll. Alg. **2**: 1275. 1894.

Coscinodiscus centralis Ehrenb. Mikrog. *pl. 21. f. 3.* H. L. Smith, Sp. Diat. Typ. no. 91 (not no. 92). 1874.

Rattray unites with the above list *C. omphalanthus* Grun.,[c] *C. asteromphalus* Ehrenb.,[d] and *Cestodiscus radiatus* Ehrenb.[e] I do not think these can be classed here. I also look on Rattray's *C. oculus-iridis loculifera*[f] as of doubtful worth.

Found at stations 2929, 3604, 4530H, off southern California and Bering Sea.

Coscinodiscus pentas (Ehrenb.) Mann.

Symbolophora pentas Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 205. 1845; Mikrog. *pl. 35A. XXII. f. 19.* 1854. Griff. & Henf. Micr. Dict. ed. 3. *pl. 43. f. 56.* 1875. Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872**: 283. *pl. 12. II. f. 1.* 1873.

Symbolophora microtrias Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 205. 1845; Mikrog. *pl. 35A, 21. f. 16.* 1854. Pritch. Hist. Infus. ed. 4. 833. 1861. Griff. & Henf. Micr. Dict. ed. 3. *pl. 43. f. 55.* 1875.

Symbolophora tetras Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 205. 1845. Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872**: 394. *pl. 12. II. f. 1.* 1873.

Symbolophora hexas Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 205. 1845.[g]

Coscinodiscus stellaris Roper, Quart. Journ. Micr. Sci. **6**: 21. *pl. 3. f. 3.* 1858. Moeb. Diat.-taf. *pl. 13. f. 3.* Pritch. Hist. Infus. ed. 4. 828. *pl. 5. f. 83.* 1861. Castr. Rep. Voy. Chall. Bot. **2**: 155, 158. *pl. 3. f. 2. pl. 5. f. 9.* Grove; Schmidt, Atlas

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[a] Van Heur. Synop. *pl. 129. f. 4.* 1881.

[b] Mem. Soc. Phys. et Hist. Nat. Geneva **31**^{1}: 23. *pl. 20. f. 2.* 1891.

[c] Schmidt, Atlas *pl. 63. f. 2.* 1878.

[d] Schmidt, Atlas *pl. 60. f. 7.* 1878 and Grun. Denkschr. Akad. Wien **48**^{2}: 77. 1884.

[e] Van Heur. Synop. *pl. 129. f. 5.* 1881.

[f] Proc. Roy. Soc. Edinb. **16**: *pl. 1. f. 2.* 1889.

[g] *Symbolophora microtetras* Ehrenb., *S. micropentas* Ehrenb., and *S. microhexas* Ehrenb. Monatsber. Akad. Wiss. Berl. **1855**: 302. 1856, are all nomina nuda. *S. trinitatis* Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 88. 1845. Pritch. Hist. Infus. ed. 4. 833. *pl. 11. f. 36.* 1861. Griff. & Henf. Micr. Dict. ed. 3. *pl. 19. f. 6.* 1875. Am. Journ. Sci. **48**: *pl. 4. f. 1.* 1845 is here excluded, as it is an Actinoptychus.

pl. 164. f. 4. O'Meara, Proc. Roy. Irish Acad. II. **2**: 261. 1875. Ratt. Proc. Roy. Soc. Edinb. **16**: 493. 1889. Grun. Denkschr. Akad. Wien **48**^{2}: 82. 1884. De Toni, Syll. Alg. **2**: 1231. 1894.

Coscinodiscus symbolophorus Grun. Denkschr. Akad. Wien **48**^{2}: 82. *pl. 4. f. 3–6.* 1884. Ratt. Proc. Roy. Soc. Edinb. **16**: 492. 1889. Schmidt, Atlas *pl. 138. f. 1–5.* De Toni, Syll. Alg. **2**: 1230. 1894.

I include in this species a large number of varieties found in the various dredgings and soundings named. I am convinced that there is no reasonable ground for Grunow's *C. symbolophorus* as distinguished from Roper's older name *C. stellaris*. Grunow admits that the difference is one of relative fineness of marking—too slight a character for creating a new species, especially when this difference is by no means striking and many intermediate forms are obtainable. Both have the same relative convexity of valve; the same striking stellate cluster at the center; the same arrangement of fine beading, namely, in fascicles whose component rows are parallel to the longest radial middle row. By thus abandoning the untenable distinction separating these two we have a sharply defined species, its nearest relative being *C. subtilis* Ehrenb., from which it is distinguished by the stellate marking of the center and the absence of minute processes next the border. The older specific names of Ehrenberg given above under the now-abandoned genus Symbolophora take precedence over those of Grunow and Roper. I have selected *S. pentas*, published simultaneously with *S. microtrias* and *S. tetras*, because I have found the five-parted star at the center to be more common than the rest and because Ehrenberg's illustration cited above is quite satisfactory.

Found at stations 2807, 2848, 2859, 2860, 2919, 3346, 3361H, 3603, 3604, 3604H, 3671, 4029H, Galapagos Islands, off Alaska peninsula, off British Columbia to southern California and Bering Sea.

Coscinodiscus pustulatus Mann, sp. nov. PLATE XLVIII, FIGURE 3.

Valve strongly and evenly convex, covered with large conical (not hemispherical) beads, symmetrically arranged in decussating rows, as in *C. symmetricus* Grev., the largest at the center and regularly decreasing to the border, but terminating just within the border in a single row of increased size; border broad, stout, and hyaline. The heavy cone-shaped beads give a remarkable brilliancy to the diatom.

Diameter of valve, 0.1 mm.

Type in the U. S. National Museum, No. 590156, from station 3565H, Bering Sea, July 6, 1895; 1,866 fathoms, bottom of blue mud ooze.

It should be here noted that what resembles a pseudonodule near the border in the photograph herewith reproduced is, together with three flecks near the center, due to defects in the negative.

Coscinodiscus radiatus Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1839**: 148. *pl. 3. f. 1a–c* (not *d.*). 1841; Mikrog. *pl. 19. f. 1, pl. 22. f. 3, pl. 33. XIII. f. 2* (not *2**), *pl. 33. XVI. f. 6, pl. 35A. XVII. f. 6* (doubtful=*pl. 20. I. f. 27, pl. 21. f. 1*). 1854. Pritch. Hist. Infus. ed. 4. 830. *pl. 11. f. 39, 40.* 1861. Schmidt, Atlas *pl. 60. f. 5, 6, 9, 10, pl. 61. f. 13* (undetermined). 1878; *pl. 65. f. 8* (no name). 1881; *pl. 113. f. 8, 15* (no name). *21.* 1888. Schmidt, Jahresb. Komm. Deut. Meere **2**: 94. *pl. 3. f. 34.* 1874. Grun. Denkschr. Akad. Wien **48**^{2}: 71. *pl. 3. f. 1–4, 7.* 1884. Cleve & Möll. types no. 57, 114, 155, 164, 207, 211, 215, 257. Van Heur. Synop. *pl. 129. f. 1.* 1881. Castr. Rep. Voy. Chall. Bot. **2**: 165. *pl. 29. f. 2, 11, 15.* 1886. Ratt. Proc. Roy. Soc. Edinb. **16**: 514. 1889. De Toni, Syll. Alg. **2**: 1244. 1894. (exclude here *C. radiatus* Bail. Am. Journ. Sci. **42**: 95. *pl. 2. f. 14.* 1842; also *C. radiatus* Weisse, Bull. Acad. St. Petersb. **12**: 122. *pl. 1. f. 25.* 1868).

Coscinodiscus caspius Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872**: 394. *pl. 12. I. f. 14.* 1873.

Coscinodiscus borealis Ehrenb. Monatsber. Akad. Wiss. Berl. **1861**: 294. 1862, not *C. borealis* Bail. Am. Journ. Sci. **22**: 3. 1856.

Coscinodiscus devius Schmidt, Atlas *pl. 60. f. 1–4.* 1878. Van Heur. Synop. *pl. 130. f. 3.* 1881. Cleve & Möll. type no. 150.

Coscinodiscus fallax Schum. Schrift. Phys. Ökon. Gesell. Konigsb. **8:** 62. *pl. 3. f. 76.* 1867 (cf. Castr. Rep. Voy. Chall. Bot. **2:** 165. *pl. 29. f. 2, 11, 15.* 1886).

Rattray includes under the above category several references,[a] which are omitted here.

Found at stations 2807, 3604, 2835, Galapagos Islands, off Lower California and Bering Sea.

Coscinodiscus robustus Grev. Trans. Micr. Soc. Lond. n. s. **14:** 3. *pl. 1. f. 8.* 1866. Moeb. Diat.-taf. *pl. 70. f. 8.* 1890. Jan. Diat. Gaz. Exped. *pl. 4. f. 10–11.* Schmidt, Atlas *pl. 62. f. 16, 17* (not *f. 1–6*). 1878. Grun. Denkschr. Akad. Wien **48^2:** 72. 1884. Ratt. Proc. Roy. Soc. Edinb. **16:** 511. 1889. De Toni, Syll. Alg. **2:** 1243. 1894. PLATE XLVIII, FIGURE 4.

Coscinodiscus subvelatus Grun.; Schmidt, Atlas *pl. 65. f. 9.* 1881.

Coscinodiscus marginatus Ehrenb. var. Grun. Denkschr. Akad. Wien **48^2:** 72. 1884.

Coscinodiscus kinkerianus Truan & Witt, Diat. Hayti 13. *pl. 3. f. 1.* 1888.

Greville's figure and its reproduction cited above by Moebius are, as Rattray points out, somewhat idealized. A variety was found at station 3399H corresponding to the one that Schmidt[b] considers doubtful. *C. subvelatus* Grun. is also a rather too divergent variety, while *C. kinkerianus* Truan & Witt is either a variety with unusually narrow margin or a type form with margin wanting. The confusion between this species and *C. marginatus* Ehrenb. has been discussed under that heading.

Found at stations 3346, 3361H, 3399H, 3604, 3663H, 3693H, 3784, 3785, 4023H, 4025H, off Washington, Bering Sea and Okhotsk Sea.

In Rattray's revision[c] occurs this paragraph: "In a Santa Monica form, 13 mm. in diameter, discovered by Doctor Rae, the usual striated border was surrounded by a second more sharply defined but narrower band, with a slightly convex surface, and bearing delicate striae, 8 to 10 in 0.01 mm. At one place this band is interrupted and somewhat more convex on the two sides of the break. This gives it the appearance of an elastic spring enveloping the valve." Specimens of this structure are not infrequent at station 3361H, which is in Bering Sea northwest from Pribilof Islands. At station 4025H, a little north of the Aleutian Islands, it is decidedly abundant. Nor is such a band confined to this species. Brun[d] figures precisely this condition on a specimen of *C. crassus* Bail. It would be interesting to know the precise physiological signification of this feature, its only occasional presence in the different species implying that it has such signification. Figures of this form and a morphological discussion of the interrupted diatom girdle have been published by Palmer & Keeley.[e] The form found at station 4025H is represented in the accompanying figure.

Coscinodiscus simbirskianus Grun. Denkschr. Akad. Wien **48^2:** 81. 1884. Schmidt, Atlas *pl. 113. f. 11–12.* 1888. Ratt. Proc. Roy. Soc. Edinb. **16:** 489. 1889. De Toni, Syll. Alg. **2:** 1228. 1894.

My specimen is a typical example of this unusual species. As the sounding in which it occurred was made off the coast of Alaska, and as the only places heretofore reported where it has been found are in Russia (i. e. Simbrisk, Ananino, and Archangelsk-kurojedowo), it would be interesting to know the geological outcrop that furnished this specimen.

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[a] Ehrenb. Mikrog. *pl. 33. XIII. f. 2*.* Schmidt, Atlas *pl. 62. f. 18.* 1878. H. L. Smith, Sp. Diat. Typ. no. 99. This last is probably an error. No. 99 is marked *C. scintillans* Grev., and contains no example of *C. radiatus*. No. 98 is marked *C. radiatus* Ehrenb., but is wrong. It is *C. nodulifer* Schmidt.

[b] Schmidt, Atlas *pl. 62. f. 1. 1878.*

[c] Proc. Roy. Soc. Edinb. **16:** 512. 1889.

[d] Mem. Soc. Phys. et Hist. Nat. Geneva **31^1:** *pl. 20. f. 3.* 1891.

[e] Proc. Acad. Phila. **1900:** 465–479. *pl. 15–16.* 1900.

Found at station 3361H, Bering Sea.

Coscinodiscus subtilis Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 412. *pl. 1. III. f. 18, pl. 3. VII. f. 4.* 1843; Mikrog. *pl. 18. f. 35, pl. 33. XIII. f. 4, pl. 33. XVI. f. 7, pl. 34. VII. f. 6, pl. 35. XXII. f. 5, pl. 35. XXIII. f. 5.* 1854. Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 438. *pl. 1. III. f. 18.* 1843. Grev. Quart. Journ. Micr. Sci. **7:** 81. 1859. Pritch. Hist. Infus. ed. 4. 830. 1861. Jan. Abh. Schl. Ges. Vaterl. Cult. **1862**^{2}: 4. *pl. 1A. f. 2.* 1862. Jan. Diat. Gaz. Exped. *pl. 2. f. 8.* Schmidt, Atlas *pl. 57. f. 11–16.* 1878. H. L. Smith, Sp. Diat. Typ. no. 100. Ratt. Proc. Roy. Soc. Edinb. **16:** 494. 1889. De Toni, Syll. Alg. **2:** 1232. 1894 (exclude Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 443. *pl. 3. VII. f. 4.* 1843. Grun. Denkschr. Akad. Wien **48**^{2}: 81. *pl. 3. f. 26.* 1884. Ehrenb. Mikrog. *pl. 22. f. 4.* 1854).

Rattray has included here several references which are very questionable.[a] The two varieties described by him[b] are very unsatisfactory and uncertain examples of this species. Its boundaries are unquestionably misty. It approaches *C. normanni* Greg., *C. odontophorus* Grun., *C. rothii* Grun., *C. symmetricus* Grev., *C. fasciculatus* Schmidt, *C. denarius* Schmidt. H. L. Smith's type no. 100 is truly typical. Compare synonymy of *C. normanni* Greg.

Found at stations 2844, 3526, 3604H, 3607, 3635H, Aleutian Islands and Bering Sea.

Coscinodiscus undulosus Mann, sp. nov. PLATE XLIX, FIGURE 1.

Frustules small and very delicate; valves slightly and evenly convex; markings of oval beads elongated in the radial line, all of one size very small, arranged in radiating rows, but so spaced in the rows as to produce a uniform delicate wavy appearance over the entire valve; border moderately broad, perfectly smooth. A fragile and handsome species, found only in the following dredging, there quite abundant.

Diameter of valve, 0.125 to 0.136 mm.

Type in the U. S. National Museum, No. 590121, from station 3526, Bering Sea, August 5, 1893; 49 fathoms, bottom of fine sand and dark mud.

Coscinodiscus verecundus Mann, sp. nov. PLATE L, FIGURE 1.

Valve nearly flat; central area very minute or wanting, marking of minute beads, the largest at the center and regularly decreasing to the border; arranged in indistinct fascicles, 12 to 14 in number, irregular in width, showing the watch-milling effect of an Actinocyclus; border of two distinct portions equal in width, namely, each about one-twentieth the radius; the inner portion a smooth band ornamented with evenly set, large but dim beads in a single circle; the outer portion strongly marked with transverse (radial) striae, slightly wider on the outer side. The entire valve most delicate and pellucid.

Diameter of valve, 0.078 mm.

Type in the U. S. National Museum, No. 590122 from station 3688H, Okhotsk Sea, August 27, 1896; 1,562 fathoms, bottom of brown mud and fine sand.

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[a] Jan. Diat. Gaz. Exped. *pl. 4. f. 1–2* (named *C. lentiginosus* Jan.), *pl. 5. f. 7, pl. 6. f. 1, 5, pl. 20. f. 5.* Schmidt, Atlas *pl. 57. f. 28–29* (no name), *pl. 58. f. 37* (no name). 1878. Van Heur. Synop. 218. *pl. 131. f. 1.* 1881–1885 (as *C. subtilis* Ehrenb.? in text and *C. normannicus* Greg. in plate).

[b] Proc. Roy. Soc. Edinb. **16:** 497. *pl. 1. f. 16, pl. 3. f. 6.* 1889.

Coscinodiscus woodwardii Eulen. Diat. Sp. Typ. no. 116. 1868. Schmidt, Atlas *pl. 60. f. 8*, *pl. 61. f. 3.* 1878; *pl. 65. f. 2.* 1881.

I do not find satisfactory reason for placing this diatom under *C. apiculatus* Ehrenb. as is done by Rattray[a] and copied in De Toni.[b] Although our knowledge of the latter species is most obscure, yet so far as the form is now represented it has only a remote resemblance to the above. Its typical structure is with beaded valves, while the above is covered with a fine network; and although the transition from beads to hexagons by the enlargement of the beading and their subsequent lateral pressure is an easily understood one, I think the form is then so far from the type as to have passed over into another species. Rattray has, I think, suggested a more important affinity than the one above by his remark[c] that *C. apiculatus* "when its markings are polygonal and in contact is distinguished from *C. radiatus* Ehrenb. by the presence of a central space." This is very nearly the structure represented by *C. woodwardii*, which I would therefore prefer to place as a variety of *C. radiatus* rather than to unite it with *C. apiculatus*, as I look upon the minute and irregular central area of this species as less significant than the striking structural contrast between it and *C. apiculatus*. But for the present at least it is better to keep this species independent, as is done by Grunow, Schmidt, and others. Habirshaw makes this name synonymous with *C. argus* Ehrenb., an identification quite out of the question.

Found at station 2694H, off California.

ACTINOCYCLUS Ehrenb.

Actinocyclus Ehrenb. Ber. Akad. Wiss. Berl. **1837:** 61. 1838; Infus. 171. 1838; Ber. Akad. Wiss. Berl. **1840:** 202–204. 1841.

Pyxidicula Ehrenb. in part; Ber. Akad. Wiss. Berl. **1844:** 85. 1845.

Eupodiscus Ehrenb. in part; W. Smith, Synop. Brit. Diat. **1:** 24. *pl. 4. f. 41.* 1853. Breb. Journ. Quek. Micr. Club **2:** 71. 1870. Greg. Trans. Roy. Soc. Edinb. **21:** 501. 1857.

Actinoptychus Ehrenb. in part; Ehrenb. Mikrog. *pl. 18. f. 12.* 1854. Kütz. Bacill. 134. 1844. Bright. Quart. Journ. Micr. Sci. **8:** 94. 1860.

Auliscus Ehrenb. in part; Rabh. Fl. Eur. Alg. **1:** 320. 1864.

Hyalodiscus Ehrenb. in part; H. L. Smith, Amer. Journ. Micr. **2:** 100. 1877.

Stictodiscus Grev. in part; Grun.; Van Heur. Synop. *pl. 118. f. 4.* 1881.

Podosira Ehrenb. in part; Grun.; Van Heur. Synop. *pl. 118. f. 5.* 1881.

Micropodiscus Grun.; Van Heur. Synop. *pl. 118. f. 5.* 1881.

Roperia Grun.; Grun in Van Heur. Synop. *pl. 118. f. 6.* note. 1881. Ratt. Journ. Roy. Micr. Soc. **8**^{2}: 917. 1888.

Coscinodiscus Ehrenb. in part; Grun. Denkschr. Akad. Wien **48**^{2}: 83. 1884. Norm. Trans. Micr. Soc. Lond. n. s. **9:** 7. 1861. Grove, Proc. Roy. Soc. Edinb. **17:** 449. 1890.

This genus is one of extreme difficulty—first, because of the remarkable confusion between it and other genera, especially in the earlier writers; the result being that such actinocycloid forms as are treated by them are difficult to find. This is especially the case in regard to this genus and Actinoptychus Ehrenb., on the part of Ehrenberg, Kützing, Greville, Brightwell, and others, a condition growing out of the fact that when Ehrenberg first constituted the genus Actinocyclus it made no distinction between these and the Actinoptychus forms, which, though so dissimilar, were not separated until 1840, when Ehrenberg created the genus Actinoptychus for that purpose. Kützing, Greville, and Brightwell, however, ignored this latter genus, and so perpetuated the error. In addition to the confusion between the above-mentioned genera, there is a second reason for the difficulty here encountered, and one that partly explains the other; the inconstant and rather trivial generic distinction between this and Coscinodiscus Ehrenb. The general structure and markings are those of the latter genus, and the one striking distinguishing feature, the "pseudonodule" of Actinocyclus, is unquestionably very inconstant. Some species, like *A. pyrotechnicus* Deby, seem fairly well marked and stable; but many others differ from well-known species of Coscinodiscus only in the presence of this pseudonodule, and it is not unusual to find specimens both with and without this structure in the same gathering. Thus *C. curvatulus* Grun., is *A. curvatulus* Jan., without its pseudonodule; so also *C. subtilis* Ehrenb. and *A. subtilis* Greg., *C. fuscus* Norm., and *A. ralfsii* (W. Smith) Ralfs, *C. tuberculatus* Grev., and *A. sparsus* (Greg.) Ratt.; while in H. L. Smith's type slide no. 12 the form he calls "*Actinocyclus interpunctatus* Bright.," is uniformly lacking in the pseudonodule and agrees exactly with his type slide no. 421, marked "*Podosira marima* Grun." There might be mentioned a third reason for the difficult character of this genus, namely, the lack of good literature on the subject and especially of good figures of the species. Rattray's revision of Actinocyclus[a] contains some excellent work, but it leaves much to be desired. Too many old specific names have been disturbed; the illustrations are scanty and too small, and the analytical key is most difficult to use. Schmidt's Atlas has so far practically ignored this much needed subject, an undertaking of far more importance to the science than the wearisome reillustration of species already repeatedly figured in its plates.

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[a] Proc. Roy. Soc. Edinb. **16:** 571. 1889.

[b] De Toni, Syll. Alg. **2:** 1283. 1894.

[c] Op. cit. 570.

Actinocyclus alienus Grun.; Van Heur. Synop. *pl. 125. f. 10, 12.* 1881. Ratt. Journ. Quek. Micr. Club II. **4**: 144. 1890. Wolle, Diat. N. A. *pl. 85. f. 14.* 1890. De Toni, Syll. Alg. **2**: 1165. 1894.

The specimens found by me agree with what Grunow calls variety *californica*,[b] which is the type of the species.

Found at station 3361H, off the coast of Alaska.

Actinocyclus crassus (W. Smith) Van Heur. Synop. *pl. 124. f. 6, 8.* 1881. De Toni, Syll. Alg. **2**: 1169. 1894.

Eupodiscus crassus W. Smith, Synop. Brit. Diat. **1**: 24. *pl. 4. f. 41.* 1853.

Actinocyclus subcrassus Ratt. Journ. Quek. Micr. Club II. **4**: 154. 1890.

Actinocyclus circumdatus Pant. Bacill. Ung. **1**: 66. *pl. 3. f. 28.* 1887.

Van Heurck's figure is hardly typical, as the beading is radially arranged in the type. Rattray's proposition to make a new species of the nonradial forms is, however, not to be commended. They should be looked upon as varieties of the above.

Found at station 3346, off the coast of Washington.

Actinocyclus curvatulus Jan.; Schmidt, Atlas *pl. 57. f. 31.* 1878. Wolle, Diat. N. A. *pl. 94. f. 14.* 1890.

Coscinodiscus curvatulus subocellatus Grun. Denkschr. Akad. Wien **48**^{2}: 83. *pl. 4. f. 15.* 1884.

Actinocyclus subocellatus Ratt. Journ. Quek. Micr. Club II. **4**: 145. 1890.

The above differs merely in its pseudonodule from *Coscinodiscus curvatulus* Grun.,[c] a difficulty that Grunow tries to avoid by making this species a form as variety *subocellatus* of that species.

Found at station 2807, Galapagos Islands.

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[a] Journ. Quek. Micr. Club II. **4**: 137-212. *pl. 11.* 1890.

[b] Van Heur. Synop. 125. *pl. 25. f. 10.*

[c] Schmidt, Atlas 57. *f. 33.* 1878.

Actinocyclus (?) **elongatus** Grun.; Van Heur. Synop. *pl. 125.f. 15, 17.* 1881.

I am in harmony with Van Heurck in doubting the correctness of calling this an Actinocyclus. Not only the extreme contrast of this elongated form with any known Actinocyclus (my specimen is twenty times as long as wide), but the absence of any true pseudonodule makes this classification unsatisfactory. In my specimen at least, the dot which Grunow considers a pseudonodule is only an enlarged bead on the upper surface of the valve, and lacks the shimmering appearance of the true pseudonodule. In my form also, as in Van Heurck's figures, there are two such, located at short distances from the two ends. Rattray[a] states that the pseudonodule is genuine in a *Tuscarora* valve, but doubts its genuineness in another subspecies which Grunow for that reason names *A. elongatus dubia.*[b] The fact is, we have here another illustration of the difficulty of considering Actinocyclus anything more than a subgenus of Coscinodiscus. Compare the figures of Van Heurck[b] with that of *Coscinodiscus elongatus* Grun. in figure 14 of the same plate.

Found at station 2919, off the coast of southern California.

Actinocyclus interpunctatus (Bright.) Ralfs in Pritch. Hist. Infus. ed. 4. 835. 1861. Ratt. Journ. Quek. Micr. Club II. **4:** 203. 1890. (Not H. L. Smith typ. no. 12.)
Actinoptychus interpunctatus Bright. Quart. Journ. Micr. Sci. **8:** 94. *pl. 6.f. 17.* 1860.
Hyalodiscus stelliger Bail. err. det. Möll. Amer. Journ. Micr. **2:** 100. 1877.
Eupodiscus (*Actinoptychus*) *interpunctatus* Bright.; Grun. Amer. Journ. Micr. **8:** 101-102. 1878.

The above is perhaps a broad variety of *A. ralfsii* (W. Smith) Ralfs, and differs little from *A. sparsus* (Greg.) Ratt. The slide in H. L. Smith's type no. 12, bearing the above name and identical with his slide 421, marked "*Podosira maxima* Grun.," is better considered a variety of *A. ralfsii*, that is, if that species and this one are to be kept separate. Ralfs was himself doubtful about this form being a valid species. I share this doubt. Still, as there is ground for question on this point, it is perhaps best to accept Rattray's decision and retain the above name.

Found at station 4505H.

Actinocyclus minutus Grev.; Ratt. Journ. Quek. Micr. Club II. **4:** 170. *pl. 11.f. 4.* 1890.

The original specimens came from Manila; this one from the Galapagos Islands.

Found at station 2807, Galapagos Islands.

Actinocyclus oliverianus O'Meara, Jour. Linn. Soc. Bot. **15:** 58. *pl. 1.f. 7.* 1876 (?). Castr. Rep. Voy. Chall. Bot. **2:** 145. *pl. 4.f. 7.* 1886. Ratt. Journ. Quek. Micr. Club II. **4:** 148. 1890.
Podosira oliveriana Grun.; Van Heur. Synop. *pl. 118.f. 5.* 1881.
Micropodiscus oliverianus Grun.; Van Heur. Synop. *pl. 118.f. 5.* 1881; Denkschr. Akad. Wien **48**^{2}: 79. 1884.
Actinocyclus umbonatus Castr. Rep. Voy. Chall. Bot. **2:** 145. *pl. 4.f. 4.* 1886.

It is difficult to decide on the genus of this diatom. It has the shimmering pseudonodule of Actinocyclus, the watch-case milling of Podosira and the general border of Craspedodiscus. I place it as above because my form, unlike that figured by Van Heurck and the one referred to by Rattray, has a true pseudonodule, a large, hyaline, refractive globule, and not the small process of Van Heurck's and Rattray's figures. The view of Van Heurck and of Grunow, who looked on this as a species of Podosira, does not seem to me to be tenable. It may be found necessary to adopt Grunow's suggestion of putting this in a new genus Micropodiscus; though the name would be bad, as some specimens have, as above stated, not a "little foot," but a very evident pseudonodule. Castracane's figure gives emphasis to contorted markings that do not occur in all cases. I do not agree with Rattray that *Actinocyclus antarticus* Castr.[a] and *A. umbonatus* Castr.[b] are synonymous with the above. The failure to find a pseudonodule in the original specimen by O'Meara is probably explained by the inconstancy of that structure.

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[a] Journ. Quek. Micr. Club II. **4:** 197. 1890.

[b] Van Heur. Synop. *pl. 125.f. 16-17.* 1881.

Found at station 2859, off the coast of Alaska.

Actinocyclus ralfsii (W. Smith) Ralfs in Pritch. Hist. Infus. ed. 4. 835. *pl. 5. f. 84.* 1861. Van Heur. Synop. 215. *pl. 123. f. 6, pl. 124. f. 1–4.* 1881. O'Meara, Proc. Roy. Irish Acad. II. **2**: 268. *pl. 37. f. 1.* 1875. Ratt. Journ. Quek. Micr. Club II. **4**: 155. 1890. De Toni, Syll. Alg. **2**: 1170. 1894. Castr. Rep. Voy. Chall. Bot. **2**: 143. *pl. 30. f. 1.* 1886. Eng. & Pr. Pflanzenfam. 1^{1b}: 78. *f. 119B.* 1896. Blake, Trans. Wisc. Acad. **14**: 108. *pl. 3–4.* 1903.

Eupodiscus ralfsii W. Smith, Synop. Brit. Diat. **2**: 86. 1856. Moeb. Diat.-taf. *pl. 5. f. 11.* 1890.

Eupodiscus sparsus Greg. Trans. Micr. Soc. Lond. n. s. **5**: 81. *pl. 1. f. 47.* 1857.

Coscinodiscus fuscus Norm. Trans. Micr. Soc. Lond. n. s. **9**: 7. *pl. 2. f. 3.* 1861.

Actinocyclus fuscus H. L. Smith, Sp. Diat. Typ. no. 11. 1874.

The specimens found at station 3611 are a small and coarse variety similar to the figure in Moebius cited above.

Found at stations 3361H and 3611, off the coast of Alaska.

Actinocyclus sparsus (Greg.) Ratt. Journ. Quek. Micr. Club II. **4**: 156, 170. 1890. De Toni, Syll. Alg. **2**: 1177. 1894.

Eupodiscus sparsus Greg. Trans. Micr. Soc. Lond. n. s. **5**: 81. *pl. 1. f. 47.* 1857. Moeb. Diat.-taf. *pl. 12. f. 47.* 1890.

Actinocyclus ralfsii sparsus Ralfs, Pritch. Hist. Infus. ed. 4. 835. 1861. Cleve & Möll. type no. 115. 1878.

Actinocyclus fasciculatus Castr. Rep. Voy. Chall. Bot. **2**: *pl. 4. f. 8–8bis.* 1886.

As Rattray points out,[c] it is a matter of doubt if this form is not to be looked upon as a variety of *A. ralfsii*, thus agreeing with Ralfs's opinion[d] in Pritch. Hist. Infus. above. But, like Rattray, I feel that this union is questionable enough to warrant the separation, at least for the present. As has been pointed out in the discussion of the genus, the above differs from *Coscinodiscus tuberculatus* Grev., only in the presence of a pseudonodule.[e]

Found at station 3346, off the coast of Washington.

Actinocyclus subtilis (Greg.) Ralfs in Pritch. Hist. Infus. ed. 4. 835. 1861. Ratt. Journ. Quek. Micr. Club II. **4**: 188. 1890. H. L. Smith, Am. Journ. Micr. **2**: 101. 1877. H. L. Smith, Sp. Diat. Typ. 14. 1874. Van Heur. Synop. 216. *pl. 124, f.* 7. 1881. De Toni, Syll. Alg. **2**: 1183. 1894.

Eupodiscus subtilis Greg. Trans. Roy. Soc. Edinb. **21**: 501. *pl. 11. f. 50.* 1857, not Ehrenb. 1855, nom. nud.

Eupodiscus gregorianus Breb. Journ. Quek. Micr. Club **2**: 41. 1870.

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[a] Rep. Voy. Chall. Bot. **2**: 145. 1886.

[b] Loc. cit. *pl. 4. fig. 4.*

[c] Journ. Quek. Micr. Club II. **4**: 156. 1890.

[d] Cf. Pritch. Hist. Infus. ed. 4. 835. 1861.

[e] See Greville's original figure in Trans. Micr. Soc. Lond. n. s. **9**: 42. *pl. 4. f. 6.* 1861, or Moeb. Diat.-taf. *pl. 37. f. 6.* 1890.

The name "*Eupodiscus* ? *subtilis*" Ehrenberg[a] ought to be dropped out of consideration, as there is no indication of the character of the diatom the author had in mind. Ralfs's species, however, differs in no respect, except in its pseudonodule, from *Coscinodiscus subtilis* Ehrenb.[b] and especially from the figures in Schmidt's Atlas *pl. 57. f. 11–16.*

Found at stations 3669H, Kuril Islands, and 3688 H, Sea of Okhotsk.

Actinocyclus tesselatus (Roper) Ralfs in Pritch. Hist. Infus. ed. 4. 835. 1861.

Eupodiscus tesselatus Roper, Quart. Journ. Micr. Sci. **6**: 19. *pl. 3. f. 1–1.* 1858. Moeb. Diat.-taf. *pl. 13. f. 1–1b.* 1890.

Roperia tesselata Grun.; Van Heur. Synop. *pl. 118. f. 6–7.* 1881. Ratt. Journ. Roy. Micr. Soc. **8**^{2}: 57. 1888. De Toni, Syll. Alg. **2**: 1087. 1894.

As has been pointed out in the discussion of the genus, the sole difference between Actinocyclus and Coscinodiscus is the presence in the former of the pseudonodule. Although this species contrasts strongly with others of the genus because of its reticulated marking, it does not differ in that respect from Coscinodiscus, where such markings are the dominant ones. I see, therefore, no reason to place this in a new genus. The pseudonodule is less dense and convex than in most Actinocycli, though there are exceptions even to this; but there can be no question that it is the homologue of that structure.

Found at stations 2680H, 2690H, between San Francisco and Hawaii.

CRASPEDODISCUS Ehrenb.

Craspedodiscus Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 200. 1845; Mikrog. *pl. 18. f. 108.* Pritch. Hist. Infus. ed. 4. 831, 939. 1861. De Toni, Syll. Alg. **2**: 1198. 1894 Griff. & Henf. Micr. Dict. ed. 3. 203. *pl. 43. f. 21.* 1875. Bright. Quart. Journ. Micr. Sci. **8**: 95. *pl. 5. f. 6, pl. 6. f. 12.* Moeb. Diat.-taf. *pl. 29. f. 12.* 1890.

Coscinodiscus Ehrenb. in part; Kütz. Sp. Alg. 126. 1849.

Pyxidicula Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 85. 1845, in part.

Porodiscus Grev. in part; Grun.; Schmidt, Atlas *pl. 66. f. 6.* 1888.

Hyalodiscus Ehrenb. Ber. Akad. Wiss. Berl. **1853**: 526. 1854, in part; Mikrog. *pl. 35A. xxiii. f. 6a–b.* 1854.

Although this genus is of questionable validity it is not possible at this time to distribute its members among the two or three genera which it most nearly resembles. It stands closest to Coscinodiscus, as is evident by such examples of *Craspedodiscus coscinodiscus* Ehrenb. as that figured in Schmidt.[c] On the other hand, it leads over imperceptibly into Porodiscus Grev., as in the case of Schmidt's figure,[d] which Grunow calls *Craspedodiscus oblongus*, but which Rattray[e] looks upon, and rightly, as *Porodiscus oblongus* Grev. Nor is it surprising that in such cases of Brightwellia as have a very minute ring of beads separating the central portion from the outer band of the valve, this ring should be looked upon as essentially the same as the suture that usually separates these two portions in Craspedodiscus.[f] It is, however, best to hold this genus distinct; and accordingly the union of it with Coscinodiscus by Kützing[g] has been generally disregarded.

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[a] Ehrenb. Ber. Akad. Wiss. Berl. **1855**: 302. 1856.

[b] Phys. Abh. Akad. Wiss. Berl. **1841**: 412. *pl. 1. III. f. 18.* 1843.

[c] Schmidt, Atlas *pl. 66. f. 3.* 1881.

[d] Op. cit. *f. 7–9.*

[e] Proc. Roy. Soc. Edinb. **16**: 674. 1889.

[f] Cf. Bright. Quart. Journ. Micr. Sci. **8**: 95. *pl. 5. f. 6.* 1860,

[g] Kütz. Sp. Alg. 126. 1849,

Craspedodiscus coscinodiscus Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 266. 1845; Mikrog. *pl. 18. f. 108, pl. 33. XV. f. 8, pl. 33. XVI. f. 8.* 1854. Pritch. Hist. Infus. ed. 4. 832. *pl. 5. f. 80.* 1861. O'Meara, Proc. Roy. Irish Acad. II. **2:** 266. *pl. 26. f.* 26. 1874. Schmidt, Atlas *pl. 66. f. 3–5.* 1881; *pl. 184. f. 4.* 1893. Bright. Quart. Journ. Micr. Sci. **8:** 95, 139. *pl. 5. f. 4.* 1860, correction. Grun. in Fenzl, Reise Novara Bot. **1:** 26, 194. 1870. Ratt. Proc. Roy. Soc. Edinb. **16:** 600. 1889. De Toni, Syll. Alg. **2:** 1199. 1894. Wolle, Diat. N. A. *pl. 86. f. 3. 8.* 1890.

Pyxidicula coscinodiscus Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 85. 1845.

Craspedodiscus microdiscus Ehrenb. Mikrog. *pl. 33. XVII. f. 4.* 1854.

Craspedodiscus pyxidicula Bright. Quart. Journ. Micr. Sci. **8:** 95. *pl. 5. f. 4.* 1860. Moeb. Diat.-taf. *pl. 28. f. 4.* 1890.

Coscinodiscus pyxidicula Kütz. Sp. Alg. 126. 1849. Griff. & Henf. Micr. Dict. ed. 3. *pl. 43. f. 21.* 1875.

Found at station 2919, off southern California.

CYCLOTELLA Breb.

Cyclotella[a] Breb. in Breb. & God. Consid. Diat. 20. 1838. Kütz. Bacill. 50. 1844. Arnott, Quart. Journ. Micr. Sci. **8:** 244. 1860. Van Heur. Synop. 213. Pritch. Hist. Infus. ed. 4. 811. 1861. Castr. Rep. Voy. Chall. Bot. **2:** 140. 1886. De Toni, Syll. Alg. **2:** 1351. 1894.

Cymbella C. Ag. Consp. Diat. 11. 1830, in part.

Pyxidicula Ehrenb. Infus. *pl. 10. f. 1.* 1838, in part.

Discoplea Ehrenb. Ber. Akad. Wiss. Berl. **1847:** 484. 1848; Mikrog. *pl. 6. II. f. 1–4, pl. 39. II. f. 29.* 1854.

In many instances single valves of this genus are identical in general build with those of Melosira C. Ag. They never, however, grow in connected chains or filaments, as do those of the latter genus. Their sculpturing is also usually sui generis. The genus is universally recognized as distinct, a decided advantage in classification, in view of the size of Melosira. Although Cyclotella represents much smaller forms than those comprising the genus Coscinodiscus, the general shape and the mode of growth of the two are closely similar, and certain members of each genus are difficult to distinguish.

Cyclotella regina Mann, sp. nov. PLATE L, FIGURE 2.

Valve circular; consisting of a large central area, three-fourths the diameter of the valve and a rim one-fourth the diameter; the former nearly hyaline, but having a few scattered beads near the slightly elevated center and a narrow fringe of fine radiating lines next to the rim; rim nearly flat, showing different markings on its under and upper sides; the under (section *a* in the figure) ornamented with delicate and close transverse striae; the upper (section *b* in the figure) finely beaded on the inner half, the outer half hyaline; a fine but evident line near to and parallel with the margin.

Diameter of valve 0.088 mm.

The general appearance of this species is somewhat like *C. transylvanica* Pant.[b] Specimens are scarce at station 2807, at the Galapagos Islands, and only a single valve was found at station 2823 just inside the mouth of the Gulf of California, opposite the town of La Pax.

Type in the U. S. National Museum, No. 590123, from station 2807; also from station 2823, Galapagos Islands and Gulf of California.

Cyclotella striata (Kütz.) Grun. in Cleve & Grun. Sv. Vet. Akad. Handl. 17^2: 119 1880. Van Heur. Synop. 213. *pl. 92. f. 6–10, 12–15.* 1881. Schmidt, Atlas *pl. 223. f. 9–14.* 1896. De Toni, Syll. Alg. **2:** 1352. 1894.

Coscinodiscus striatus Kütz. Bacill. 131. *pl. 1. f. 8.* 1844.

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[a] As a subgenus by Kützing, Linnaea **8:** 535. 1833.

[b] Schmidt, Atlas *pl. 223. f. 21–27.* 1896.

Discoplea sinensis Ehrenb. Mikrog. *pl. 39. I. f. 16*, *pl. 39. II. f. 30.* 1854.
Discoplea atlantica Ehrenb. Mikrog. *pl. 39. II. f. 29.* 1854.
Cyclotella dallasiana W. Smith, Synop. Brit. Diat. **2:** 87. 1856. Rabh. Fl. Eur. Alg. **1:** 33. 1864 (not H. L. Smith. Sp. Diat. Typ. no. 102. 1874).
Cyclotella sinensis Ralfs in Pritch. Hist. Infus. ed. 4. 812. *pl. 15. f. 4.* 1861.
Cyclotella atlantica Ralfs in Pritch. Hist. Infus. ed. 4. 812. *pl. 15. f. 3.* 1861.
Cyclotella ambigua Grun. in Cleve. & Grun. Sv.Vet. Akad. Handl. **17^2:** 119. *pl. 7. f. 133.* 1880. De Toni, Syll. Alg. **2:** 1352. 1894.

Though there is similarity between this and *C. stylorum* Bright., I do not think it is sufficient to necessitate uniting them, as is done by De Toni.[a] They are held as separate by Ralfs, Schmidt, and Van Heurck. There is no doubt about *C. sinensis* (Ehrenb.) Ralfs being this species; though *Discoplea sinensis* Ehrenb., on which Ralfs bases his name, is somewhat questionable. The same is true of *C. dallasiana* W. Smith, which from the meager description and the absence of any illustration is rather indefinite. H. L. Smith's type no. 102 is a typical *C. stylorum* Bright., to which, therefore, if the two are to be held separate, it should be referred.

Found at stations 2688H, 4516H, off California and in Gulf of California.

Cyclotella stylorum Bright. Quart. Journ. Micr. Sci. **8:** 96. *pl. 6. f. 16.* 1860. Van Heur. Synop. *pl. 92. f. 2 5.* 1881 Schmidt, Atlas *pl. 223. f. 6–8.* 1896. Pritch Hist. Infus. ed. 4. 813. 1861. Moeb. Diat.-taf. *pl. 29. f. 16.* 1890.
Cyclotella dallasiana W. Smith, err. det. H. L. Smith, Sp. Diat. Typ. no. 102. 1874.

As only a single valve was found the identification is somewhat doubtful, for without a complete frustule it is nearly impossible to decide between the above species and similarly constructed valves of Melosira, as, for example, those of ***M. subornata*** Schmidt.

Found at station 3263H, south of Aleutian Islands.

HEMIPTYCHUS Ehrenb.

Hemiptychus Ehrenb. Ber. Akad. Wiss. Berl. **1848:** 7. 1849.
Arachnodiscus Bail. Ber. Akad. Wiss. Berl. **1849:** 64. 1850; in Wilkes U. S. Explor. Exped. **17:** 174. 1874. De Toni, Syll. Alg. **2:** 1311. 1894.
Arachnoidiscus Deane; Pritch. Hist. Animalc. ed. 2. 318. 1852; Hist. Infus. ed. 4. 841. *pl. 15. f. 18–21.* 1861. H. L. Smith, The Lens **1:** 19, 93. 1872.
Arachnoidiscus Bail.; W. Smith, Synop. Brit. Diat. **1:** 25. *pl. 31. f. 256.* 1853. Deane, Quart. Journ. Micr. Sci. **6:** 188. 1858.

The above name must take precedence over Arachnodiscus, which was first published in 1850, Ehrenberg crediting the name to J. W. Bailey, who probably communicated the name in a letter to Ehrenberg, as no trace of it can be found in Bailey's earlier writings. In 1850 Ehrenberg discards the earlier name, in consequence of its prior application to a genus of insects, and adopts the very appropriate and descriptive name of Arachnodiscus, which was first used in England by H. Deane (spelling it, however, as it is now generally spelled, Arachnoidiscus) in an unpublished paper read before the Microscopical Society of London on March 17, 1847.[b]

Ehrenberg's excuse for abandoning his earlier name, Hemiptychus, is not valid. I think it is both unnecessary and unwise to duplicate names in botany and zoology, and especially so where the forms are, as with the diatoms, close to the dividing line between the two kingdoms. But in this instance there is no duplication; the hemipterous name previously established by Germar in 1833[c] being Hemiptycha, not

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[a] De Toni, Syll. Alg. **2:** 1352. 1894.
[b] Quart. Journ. Micr. Sci. **6:** 188. 1858.
[c] Silb. Rev. Ent. 1833.

Hemiptychus. This latter was looked upon by Le Conte as sufficiently distinct to be given to a genus of Coleoptera in 1865.[a] As this first name of Ehrenberg's is valid and as his diagnosis is clear and his type species well defined, namely, *H. ornatus*, it must replace the better known and far more descriptive name invented by Deane.

Hemiptychus ehrenbergii (Bail.) Mann.

Arachnodiscus ehrenbergii Bail. Ber. Akad. Wiss. Berl. **1849:** 63. 1850; Wilkes U. S. Explor. Exped. **17:** 174. 1874. W. Smith, Synop. Brit. Diat. **1:** 26. *pl. 31. f. 256.* 1853. Schmidt, Atlas *pl. 68. f. 3–4.* Jan. Abh. Schles. Ges. Vaterl. Cult. **1862**^{2}: 158. *pl. 2A. f. 3. 11.* 1862. Pant. Beitr. Bacill. Ung. **1:** 69. *pl. 19. f. 169.* 1886. Truan & Witt, Diat. Hayti, *pl. 2. f. 8.* 1888.

Arachnoidiscus japonicus Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872:** 198. 1873 (not *A. japonicus* Shadb. which is *A. ornatus* Ehrenb.). Carp. Micro. ed. 8. 612. *pl. 12.* 1901.

The specimens found at station 3604 are the variety called *californica* Grun.[b]

Found at stations 2287H, 2844, 2848, 2860, 3604, 3635H, 3691H, 3693H, 3694H, 3712H, 3784H, 4013H, 4019H, 4023H, 4025H, 4029H, Bering Sea, Aleutian Islands, off British Columbia, Okhotsk Sea, and off Honshu Island, Japan.

Hemiptychus indicus (Ehrenb.) Mann.

Arachnoidiscus indicus Ehrenb. Ber. Akad. Wiss. Berl. **1854:** 165. 1855; Mikrog. *pl. 36. f. 34.* 1854. Witt. Verh. Russ. Min. Gesell. II. **22:** 153. *pl. 8. f. 4.* 1886. Pant. Beitr. Bacill. Ung. **1:** 69. *pl. 19. f. 171.* 1886. Schmidt, Atlas *pl. 68. f. 6–8.* 1881; *pl. 73. f. 2.* 1882; *pl. 201. f. 2–6.* 1896. De Toni, Syll. Alg. **2:** 1312. 1894.

This species approaches by close gradations to *H. ehrenbergii.*

Found at station 3635H, Bering Sea, between Pribilof and Aleutian Islands.

Hemiptychus ornatus Ehrenb. Ber. Akad. Wiss. Berl. **1848:** 7. 1849.

Arachnoidiscus ornatus Ehrenb. Ber. Akad. Wiss. Berl. **1849:** 64. 1850. Pritch. Hist. Infus. ed. 3. 842. *pl. 15. f. 18–21.* 1861. Schmidt, Atlas *pl. 73. f. 4–10.* 1882. Truan & Witt, Diat. Hayti 11. *pl. 2. f. 15.* 1888. Jan. Abh. Schles. Ges. Vaterl. Cult. **1862**^{2}: 22. *pl. 1A. f. 3, pl. 1B. f. 5.* 1862. De Toni, Syll. Alg. **2:** 1311. 1894. H. L. Smith, Sp. Diat. Typ. 45. 1874. Eng. & Pr. Pflanzenfam. **1**^{b}: 69. *f. 95.* 1896.

Arachnoidiscus japonicus Shadb. Trans. Micr. Soc. Lond. **3:** 319. *pl. 24. f. 18–21.* 1852 (not *A. japonicus* Ehrenb., which is *A. ehrenbergii* Bail.).

Arachnoidiscus nicobaricus Ehrenb. Ber. Akad. Wiss. Berl. **1854:** 165. 1855; Mikrog. *pl. 30. f. 35.* 1854.

Found at station 3698, off Honshu Island, Japan.

STICTODISCUS Grev.

Stictodiscus Grev. Trans. Micr. Soc. Lond. n. s. **9:** 39. *pl. 4, f. 1–4.* 1861. Truan & Witt, Diat. Hayti 18. *pl. 5.* 1888. De Toni, Syll. Alg. **2:** 1313. 1874. Castr. Rep. Voy. Chall. Bot. **2:** 112–116. 1886. Van Heur. Treat. Diat. 506. *f. 254.* 1896.

Cyclotella Kütz. Sp. Alg. 20. 1849, in part.

Triceratium Ehrenb. in part; Grev. Trans. Micr. Soc. Lond. n. s. **9:** 76, *pl. 9. f. 9.* 1861; **13:** 104. *pl. 8. f. 14.* 1865.

Discoplea Ehrenb. Mikrog. *pl. 35A. XXII. f. 6.* 1854, in part.

Actinoptychus Ehrenb. Mikrog. *pl. 19. f. 12.* 1854, in part.

Nothoceratium De Toni, Syll. Alg. **2:** 915. 1894, in part.

All specimens of this genus having polygonal instead of circular form were put by Greville and others in that unscientific complex, the genus Triceratium of Ehrenberg.

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[a] Proc. Acad. Phila. 239. 1865.

[b] Schmidt, Atlas *pl. 68. f. 3.* 1881.

The matter of this confusion has been so extensively treated by Castracane[a] that no attempt to add to what is there said is necessary here. The subject will be referred to in this report under the genus Trigonium. The present genus is in some instances so close to Hemiptychus Ehrenb. that good definitions are hard to formulate.[b] Nevertheless the utility of the two genera is considerable, and their approach is not close enough to merge this genus into that of Ehrenberg.

Stictodiscus buryanus Grev. Trans. Micr. Soc. Lond. n. s. **9**: 40. *pl. 4. f. 1–2.* 1861. Moeb. Diat.-taf. *pl. 37. f. 1–2.* 1890. Schmidt, Atlas *pl. 131. f. 3.* 1888. Truan & Witt, Diat. Hayti 19. *pl. 5. f. 1–3, 5–6, 15.* 1888. De Toni, Syll. Alg. **2**: 1313. 1894.

Stictodiscus hüttlingerianus Truan & Witt, Diat. Hayti 19. *pl. 5. f. 11.* 1888.

It is a question whether or not *S. johnsonianus* Grev. should be placed here as a synonym. The chief distinction is the single lines of radiating beads in *S. johnsonianus* and the multiple lines of beading, especially near the border, in *S. buryanus*. This difference, as seen in Greville's original figures and in plate 5 of Luard and Witt is hardly adequate to keep these apart. There is even less excuse for making a new species of *S. hüttlingerianus* on the trivial ground that the shadow lines at the center of the valve do not anastomose.

Found at stations 2807, 3784, Galapagos Islands, and north of Aleutian Islands.

Stictodiscus gelidus Mann, sp. nov. PLATE L, FIGURE 5.

Valves circular, almost flat; marked with very large flat disks, which, like the interspaces, are smooth and shining; the largest, four to five in number, arranged about the center of the valve in a ring, each disk being one-eighth the diameter of the valve in width or fully 0.01 mm. wide, thence decreasing in size to the border of the valve, where they are one-third as large; 12 to 18 radiating but irregular lines proceeding from the border toward the center, but not reaching it, as is common in this genus; at the center one smaller disk invariably perforated by a vermiform central pore, larger above and narrowing inward to a fine point; rim narrow and hyaline.

Diameter of valve, 0.058 to 0.105 mm.

Type in the U. S. National Museum, No. 590124, from station 4029H, Bering Sea, June 27, 1900; 913 fathoms, bottom of gray sand and clay.

Stictodiscus johnsonianus Grev. Trans. Micr. Soc. Lond. n. s. **9**: 41. *pl. 4. f. 3.* 1861. De Toni, Syll. Alg. **2**: 1314. 1894. Truan & Witt, Diat. Hayti 20. *pl. 5. f. 4. 9, pl. 6. f. 16.* 1888. Moeb. Diat.-taf. *pl. 37. f. 3.* 1890.

Stictodiscus jeremianus Castr. Rep. Voy. Chall. Bot. **2**: 116. 1886. Truan & Witt, Diat. Hayti 20. *pl. 5. f. 10, pl. 6. f. 2.* 1888. Schmidt, Atlas *pl. 131. f. 1.* 1888. De Toni, Syll. Alg. **2**: 1320. 1884.

Triceratium jeremianum Schmidt, Atlas *pl. 75. f. 2–2a.* 1882.

Stictodiscus truani Witt. in Truan & Witt, Diat. Hayti 19. *pl. 4. f. 23–24.* 1888. Schmidt, Atlas *pl. 131. f. 2.* 1888. De Toni, Syll. Alg. **2**: 1317. 1894.

Stictodiscus caraibicus Truan & Witt, Diat. Hayti 20. *pl. 5. f. 14.* 1888. De Toni, Syll. Alg. **2**: 1319. 1894.

Stictodiscus radiatus Castr. Rep. Voy. Chall. Bot. **2**: 117. *pl. 1. f. 1.* 1886. De Toni, Syll. Alg. **2**: 1316. 1894.

In admitting a specific difference between this diatom and *S. buryanus*, chiefly on the basis of the multiple character of the radial rows of beading in the latter and incidentally on the anastomosing of the shadow lines near its center, we certainly recognize a difference as small as is consistent with any distinction at all. There is excuse for this in the fact that all members of this genus are closely allied and differences may be recognized to divide up the large number of its forms which elsewhere would hardly serve that purpose. But having made this admission, there is nothing left on which to base a distinction between Greville's *S. johnsonianus* and those quoted above as synonyms. *Triceratium jeremianum* is simply a polygonal instead of a circular specimen of the same diatom,[a] and this divergence, being a most common one in the genus, counts for nothing. So *S. caraibicus* has a few more beads than the triangular examples of *S. johnsonianus* on the same plate. The "spiral arrangement" of the beads in *S. truani*, its only distinction, is difficult to detect and of no worth when detected. The figure of *S. radiatus* is almost as fine a copy of Greville's original figure of *S. johnsonianus* as could be asked for. Other forms might be added to the above list, as their differences are of somewhat questionable weight; as *S. pulchellus* Truan & Witt,[b] *S. grunowii* Truan & Witt,[c] *S. affinis* Castr.,[d] *S. trigonus* Castr.,[e] *S. margaritaceus* Castr.[f] A little further removed, solely by the character of the border, is *S. californicus* Grev., together with a number of its synonyms.[g]

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[a] Castr. Rep. Voy. Chall. Bot. **2**: 112–116. 1886.

[b] Cf. *Arachnoidiscus barbadensis* Schmidt, Atlas *pl. 68. f. 11*, with *Stictodiscus hardmanianus* Grev. *pl. 74. f. 8.* and these two with *Stictodiscus grovei* Schmidt, *pl. 147. f. 5–7.*

I have united a large number of circular and triangular specimens under this species, mounted specimens of which accompany this report.

Found at stations 2807, 2808, 2920H, 3008H, 3604, 4029H, Galapagos Islands, Hawaiian Islands.

Stictodiscus kittonianus Grev. Trans. Micr. Soc. Lond. n. s. **9:** 77. *pl. 10. f. 2–3.* 1861. Moeb. Diat.-taf. *pl. 4. f. 2–3.* Schmidt, Atlas *pl. 74. f. 16–18.* 1882. De Toni, Syll. Alg. **2:** 1315. 1894.

This delicate form, not infrequent in the fossil deposits of Maryland and Virginia, has been found on the Pacific slope only in the fossil beds of Monterey, California. The specimen discovered by me came from Bering Sea, north of the Aleutian Islands.

Found at station 4029H, Bering Sea.

ACTINOPTYCHUS Ehrenb.

Actinoptychus Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 400, 409. *pl. 1. I. f. 27. III. 22.* 1843; Am. Journ. Sci. **46:** 300. 1844.

Actinocyclus Ehrenb. in part; Bail. Am. Journ. Sci. **45:** *pl. 2. f. 11.* 1842.

Omphalopelta Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 270. 1845, in part. Castr. Rep. Voy. Chall. Bot. **2:** 129. *pl. 7. f. 2,* 131. *pl. 18. f. 9.* 1886, in toto.

Heliopelta Ehrenb. Mikrog. *pl. 33. XVIII. f. 5.* 1854. Johnst. Quart. Journ. Micr. Sci. **8:** 13, 18. 1860. Ralfs in Pritch. Hist. Infus. ed. 4. 840. 1861.

Halionyx Ehrenb. Mikrog. *pl. 35A. XXI. f. 12.* 1854. Jan. Abh. Schl. Ges. Vaterl. Cult. **1861²:** *pl. 1. f. 1.* 1861; **1862²:** *pl. 1a. f. 6.* 1862.

Actinophaenia Shadb. Trans. Micr. Soc. Lond. n. s. 16. 1854; Quart. Journ. Micr. Sci. **8:** 94. *pl 6. f. 18.* 1860.

Schuettia De Toni, Syll. Alg. **2:** 1395–96. 1894.

Closely allied to the above genus are Debya Pant., Anthodiscus Gr. & St., Lepidodiscus Witt, Actinodictyon Pant., Wittia Pant. They fall into H. L. Smith's family grouping Heliopelteae,[a] in which is also included Polymyxus Bail., a genus which I think has closer affinity with Aulacodiscus (Ehrenb.) Ratt.

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[a] Cf. Truan & Witt, Diat. Hayti *pl. 5. f. 9.* 1888.

[b] Truan & Witt, Diat. Hayti 20. *pl. 6. f. 5.* 1888.

[c] Op. cit. *pl. 4. f. 25, pl. 5. f. 8, pl. 6. f. 31.*

[d] Castr. Rep. Voy. Chall. Bot. **2:** 119. *pl. 1. f. 4.* 1886.

[e] Op. cit. 122. *pl. 31. f. 1.*

[f] Op. cit. 120. *pl. 17. f. 12.*

[g] Trans. Micr. Soc. Lond. n. s. **9:** 79. *pl. 10. f. 1.* 1861.

The original union of Actinoptychus and Actinocyclus by Ehrenberg and the subsequent separation of the former by the creation of that genus in 1839 has been discussed under Actinocyclus. It may be well to quote here the original Ehrenberg distinction between the two as it is given by J. W. Bailey.[b] "Under the new genus Actinoptychus are now placed those species of the old genus Actinocyclus which possess internal partitions or folds, while under the old name are retained those in which the external rays are not connected with internal folds."

Actinoptychus alternans Mann, sp. nov. PLATE XLV, FIGURE 1.

Valves circular; divided into 16 alternating segments, 8 of which bear each a minute rounded process close to the margin, its base not surrounded by a hyaline area;. these segments evenly marked with minute rows of beads, parallel to the central row or rows: that is, not radially arranged; number of rows per segment, 14 or 15: the 8 segments alternating with these without processes, marked with much larger beads regularly placed in diagonal parallel rows; inner ends of these segments proceeding slightly farther toward the center than those bearing processes, and hence giving a stellate appearance to the hyaline median area; the external ends of these segments showing a narrow hyaline band next to the rim; rim narrow, hyaline.

Diameter of valve, 0.0357 to 0.0450 mm.

The general aspect is similar to minute forms of *A. vulgaris* Schmidt and to *A. laevigatus* Grun., forma *parva*.[c] It is also apparently like the rather obscure unnamed figure[d] which Grove rightly considers to be different from *A. elegans* Ralfs.

Type in the U. S. National Museum, No. 590125, from station 4516H, Gulf of California, December 22, 1904; 1,627 fathoms, bottom of volcanic sand, obsidian, and fragments of Globigerina.

Also a variety of the above, in which the segments bearing processes are underlain with secondary markings of coarse, bead-like dots irregularly disposed.

Found at stations 2690H, between California and the Hawaiian Islands, and 4516H in the South Pacific.

Actinoptychus grundleri Schmidt, Atlas *pl. 1. f. 22.* 1875; *pl. 90. f. 7, pl. 100. f. 3-4.* 1886. Pant. Beitr. Bacill. Ung. **1**: *pl. 12. f. 106.* 1887.

My specimen differs from the type in that the hyaline spaces between the outer extremities of the segments are not united by thin hyaline bands parallel to the margin.

Found at station 2835, off Lower California.

Actinoptychus janischii Grun.; Van Heur. Synop. *pl. 122. f. 6.* 1881. Schmidt, Atlas *pl. 153. f. 8-10.* 21. 1890. Pant. Beitr. Bacill. Ung. **1**: *pl. 16. f. 143.* 1887. De Toni, Syll. Alg. **2**: 1388. 1894.

Halionyx vicenarius Jan. Abh. Schles Ges. Vaterl. Cult. **1862**^{2}: 10. *pl. 1. f. 2.* 1862.

The above specific name of Janisch, though older than *A. janischii*, was preempted by *Actinoptychus vicenarius* Ehrenb.,[e] a decidedly different diatom, without processes and having no hyaline lines bisecting the segments.

Found at station 2823.

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[a] The Lens **1**: 8, 17. 1872.

[b] Am. Journ. Sci. **46**: 300. 1844.

[c] Schmidt, Atlas *pl. 132. f. 15.* 1890.

[d] Schmidt, Atlas, *pl. 153. f. 4.* 1890.

[e] Phys. Abh. Akad. Wiss. Berl. **1841**: 410. 1843. Ehrenb. Mikrog. *pl. 18. f. 28.* 1854.

Actinoptychus mölleri Grun.; Schmidt, Atlas *pl. 132. f. 8–9.* 1888; *pl. 154. f. 5.* 1890.

In our specimens the central area is formed into a strong hyaline star by the extension of the ends of the undulating segments.

Found at station 2807, Galapagos Islands.

Actinoptychus planus Mann, sp. nov. PLATE XLV, FIGURE 2.

Valves circular, divided into six segments of equal size and identical markings, their surfaces lying nearly in one plane; three bearing each a minute globular process, set on the extreme outer margin of the valve, the alternating three showing obscure rudiments of such processes; markings of minute beading closely placed, not in perfect rows, but so arranged as to give a faintly blotched or wavy appearance to the surface; no hyaline bands at the outer margins of the segments, but their outer corners separated by small triangular hyaline areas, the extremities of the six lines of division; central area unusually small, circular, hyaline; rim a mere line, apparently smooth.

Diameter of valve, 0.0525 mm.

Type in the U. S. National Museum, No. 590126, from station 4029H, Bering Sea, June 27, 1900; 913 fathoms, bottom of gray sand and clay.

Actinoptychus punctulatus Pant. Beitr. Bacill. Ung. **1**: 62. *pl. 8. f. 60.* 1887. De Toni, Notarisia **3**: 608. 1888; Syll. Alg. **2**: 1374. 1894.

Actinoptychus intermedius Schmidt, Atlas *pl. 91. f. 3* (not *f. 2*), *pl. 109. f. 12.* 1886.

As is pointed out by De Toni[a], Schmidt has included under his name *intermedius* two quite distinct forms. That represented by figure 2 in plate 91 should be taken as type; the other (fig. 3), agreeing with Pantocsek's species, should be placed here.

Found at stations 2807, Galapagos Islands, and 2920H and 3013H, between California and Hawaii.

Actinoptychus radulus Mann, sp. nov. PLATE XLV, FIGURE 3.

Valve circular; divided into 6 equal segments, each bearing a stout, rounded process, arising close to the rim and protruding slightly beyond it, its base surrounded by a small oval or cuneiform, hyaline space which narrows inward to a thin line running to the center of the valve, thus bisecting the segment; markings of minute beads regularly arranged in diagonal cross lines; each segment slightly wider at the outer margin than its length radially, thereby leaving an unusually large hyaline central area; rim narrow, finely crossed with lines and bearing blunt, stout teeth closely set, giving to the outer edge a serrate appearance; the segments alternately slightly concave and convex, as in many other species.

Diameter of valve, 0.078 mm.

Type in the U. S. National Museum, No. 590127, from station 2920H, between California and Hawaii, November 21, 1891; 570 fathoms, bottom of brown mud and fine sand.

Actinoptychus splendens (Shadb.) Ralfs in Pritch. Hist. Infus. ed. 4. 840. 1861. Van Heur. Synop. *pl. 119. f. 1–2, 4.* 1881. Pant. Beitr. Bacill. Ung. **1**: 63. *pl. 16. f. 140.* 1887. De Toni, Syll. Alg. **2**: 1385. 1894. Schmidt, Atlas *pl. 153. f. 3, 16–17.*

Actinophaenia splendens Shadb.[b] in Bright. Quart. Journ. Micr. Sci. **8**: 94. *pl. 6. f. 18.* 1860. Moeb. Diat.-taf. *pl. 29. f. 18.* 1890.

Halionyx undenarius Ehrenb. and *H. bisenarius* Ehrenb. Abh. Schles. Ges. Vaterl. Cult. **1861²**: *pl. 1. f. 1.* 1861; **1862²**: *pl. 1A. f. 6.* 1862.

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[a] Syll. Alg. **2**: 1374. 1894.

[b] This name was originally published by Shadbolt in Trans. Micr. Soc. Lond. n. s. **2**: 16. 1854. The description is insufficient for a determination, but Brightwell's identification may be correct, inasmuch as he was a contemporary worker and may have seen authentic material.

Actinoptychus halionyx Grun. in Fenzl, Reise Novara Bot. **1**: 25. 1870.
Actinoptychus glabratus Grun.; Van Heur. Synop. *pl. 120. f. 6.* 1881. Pritch. Hist. Infus. ed. 4. 140. 1861. De Toni, Syll. Alg. **2**: 1387. 1894. Schmidt, Atlas *pl. 153. f. 7. 12, pl. 154. f. 2-4.* 1890.

Found at stations 2851, off the coast of Alaska; 2885, off the coast of Oregon, and 2920H, between California and Hawaii.

Actinoptychus undulatus (Bail.) Ralfs in Pritch. Hist. Infus. ed. 4. 839. *pl. 5. f. 88.* 1861. Schmidt, Jahresb. Komm. Deut. Meere *pl. 3. f. 29-30.* 1874. Schmidt, Atlas *pl. 1. f. 1-6.* 1875. Van Heur. Synop. *pl. 22bis. f. 14, pl. 122. f. 1-4.* 1881. Pant. Beitr. Bacill. Ung. **2**: 109. 1889. De Toni, Syll. Alg. **2**: 1372. 1894.
Actinocyclus undulatus Bail. Amer. Journ. Sci. **42**: *pl. 2. f. 11.* 1842. Kütz. Bacill. 132. *pl. 1. f. 24.* 1844.
Omphalopelta areolata Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 270. 1845: Mikrog. *pl. 35A. XVIII. f. 2, pl. 33. XIII. f. 17.* 1854. Pritch Hist. Infus. ed. 4. 841. *pl. 8. f. 15.* 1861. Griff. & Henf. Micr. Dict. ed. 3. *pl. 43. f. 58.* 1875.
Actinoptychus omphalopelta Grun. in Fenzl, Reise Novara Bot. **1**: 25. 1870.
Actinoptychus biternarius Ehrenb. Ber. Akad. Wiss. Berl. **1843**: 166. 1844; Mikrog. *pl. 33A. XVI. f. 1, pl. 18. f. 20.* 1854.

There is some doubt about the identification of many forms in Ehrenberg's works, especially in his Mikrogeologie, bearing a close resemblance to this species. It seems to me unwise to load the synonymy with names assigned by him to forms the exact character of which it is now impossible to discover. Those given above are probably specimens of this species. It is a question whether *A. senarius* Ehrenb.[a] and *A. sedenarius* Ehrenb.[b] belong here or under *A. splendens* (Shadb.) Ralfs. If their character could be clearly determined their assignment to either of these species would call for a change of the specific name. I look upon the question as far too obscure to warrant such a change.

Many wide varieties of this species were found in these investigations. Those from station 2823 have the marginal processes on alternating segments, and so protruded beyond the usual marginal curve as to give the valve an angular form. A variety from station 2807 approaches close to *A. trifurcatus* Temp. & Br.[c]

Found at stations 2807, 2823, 2835, 2848, 2851, 2859, 2860, 2882, 3346, 3603, 3604, 3671, 3691H, 3694H, 3712H, 4013H, 4014H, 4029H, 4585H, Galapagos Islands to Bering Sea, and off Honshu Island, Japan.

At station 3604 in the Bering Sea occurs the variety called "*monterey*" by Schmidt.[d]

ASTEROLAMPRA Ehrenb.

Asterolampra Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 73, 76. 1845. Grev. Trans. Micr. Soc. Lond. n. s. **8**: 108. 1860. Ratt. Proc. Roy. Soc. Edinb. **16**: 641. 1889. De Toni, Syll. Alg. **2**: 1397. 1894.
Asteromphalus Ehrenb. in part; Wall. Trans. Micr. Soc. Lond. n. s. **8**: 47. *pl. 2. f. 13.* 1860. Grev. Trans. Micr. Soc. Lond. **8**: 121. *pl. 4. f. 19.* 1860.
Craspedodiscus Ehrenb. in part; Bright. Quart. Journ. Micr. Sci. **8**: 95. *pl. 5. f. 7.* 1860. Ralfs in Pritch. Hist. Infus. ed. 4. 832. 1861.

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[a] Ehrenb. Infus. *pl. 21. f. 6.* 1838; Phys. Abh. Akad. Wiss. Berlin **1839**: *pl. 4. f. 1a-e.* 1841.

[b] Phys. Abh. Akad. Wiss. Berlin **1839**: *pl. 4. f. 2.* 1841; Mikrog. *pl.* 33. *XV. f. 4.* 1854.

[c] Mem. Soc. Phys. et Hist. Nat. Geneva **30**^{9}: *pl. 7. f. 2.* 1889.

[d] Atlas *pl. 1. f. 6.* 1875.

This genus and the next, Asteromphalus, form together a group sharply defined from all other disciform diatoms. The two genera are easily distinguished from each other by the fact that in Asteromphalus one of the radiating limbs is not symmetrical with the rest, but much narrower, and at its inner extremity, where it goes to make up the central rosette of segments, it is generally not as the rest are, i. e., wedge-shaped and terminating at the center, but is either club-shaped and extended beyond the center or rectangular and not reaching the center, or if it happen to be wedge-shaped it is smaller and narrower than the other segments. Although this asymmetry of one radiating limb in Asteromphalus is very constant in its many species, it is a rather inadequate basis for separating into two genera forms that are otherwise so much alike and are so different from all other diatoms. But for convenience of classification it is certainly advantageous to leave them as they are. The genera Rylandsia Grev., Truania Pant., Bergonia Brun, Stelladiscus Ratt., and Asterodiscus Johnst. are the nearest forms to the two above-named genera.

Asterolampra marylandica Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 76. *f. 10.* 1845. Bail. Amer. Journ. Sci. **48:** *pl. 4. f. B.* 1845. Bright. Quart. Journ. Micr. Sci. **8:** 94. *pl. 5. f. 3.* 1860. Wallich, Trans. Micr. Soc. Lond. n. s. **8:** 47. *pl. 2. f. 14–15.* 1860. Ralfs in Pritch. Hist. Infus. ed. 4. 836. *pl. 11. f. 33.* 1861. Moeb. Diat.-taf. *pl. 32. f. 1–4.* 1890. Griff. & Henf. Micr. Dict. ed. 3. *pl. 19. f. 5.* 1875. Grev. Trans. Micr. Soc. Lond. n. s. **8:** 108. *pl. 3. f. 1–4.* 1860; **10:** 44. *pl. 7. f. 1–3.* 1862. Ratt. Proc. Roy. Soc. Edinb. **16:** 193. 1889.

Asterolampra septenarius Johns. Amer. Journ. Sci. II. **13:** 33. 1852.

Asterolampra impar Shadb. Trans. Micr. Soc. Lond. n. s. **2:** 17. *pl. 1. f. 14.* 1854.

Asterolampra hexactis Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872:** 392. *pl. 9. f. 1–2.* 1873.

Asterolampra pelagica Ehrenb. Ber. Akad. Wiss. Berl. **1854:** 238. 1855?; Phys. Abh. Akad. Wiss. Berl. **1841:** 232. *pl. 6. f. 4.* 1843.

Found at stations 2807, 2920H, 2923, Galapagos Islands, Hawaiian Islands, and off southern California.

ASTEROMPHALUS Ehrenb.

Asteromphalus Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 198, 200. 1845; Mikrog. *pl. 35A. XXI. f. 3.* 1854. Ratt. Proc. Roy. Soc. Edinb. **16:** 206. 1889. De Toni, Syll. Alg. **2:** 1409. 1894.

Spatangidium Breb. Bull. Soc. Linn. Norm. **2:** 294–7. *pl. 3. f. 3.* 1857.

Actinogramma Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872:** 255, 392. *pl. 9. f. 3–6.* 1873.

Mesasterias Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872:** 392. *pl. 9. f.* 7. 1873.

Asterolampra Ehrenb. in part; Grev. Trans. Micr. Soc. Lond. n. s. **8:** 117–119. *pl. 4. f. 15–18.* 1860.

The genera nearest to this are the same as are enumerated under Asterolampra, where also the close similarity of these two genera is discussed. Greville misplaced nearly all his examples of this genus in Asterolampra.

Asteromphalus arachne (Breb.) Ralfs in Pritch. Hist. Infus. ed. 4. 837. *pl. 5. f.* 66. 1861. Schmidt, Atlas *pl.* 38. *f. 3–4.* 1876. Jan. Abh. Schles. Ges. Vaterl. Cult. **1862**^{2}: 14, *pl. 1A. f. 13, pl. 2B. f. 16.* 1862. Ratt. Proc. Roy. Soc. Edinb. **16:** 665. 1889. De Toni, Syll. Alg. **2:** 1417. 1894.

Spatangidium arachne Breb. Bull. Soc. Linn. Norm. **2:** 296. *pl. 3. f. 1.* 1857.

Asterolampra arachne Grev. Trans. Micr. Soc. Lond. n. s. **8:** 123. 1860.

Asteromphalus malleus Wall. Trans. Micr. Soc. Lond. n. s. **8:** 47. *pl. 2. f. 11.* 1860.

Asteromphalus malleiformis Wall. Trans. Micr. Soc. Lond. n. s. **8:** *pl. 2. f. 11.* expl. 1860.

There is a close resemblance between the above and *A. wallichianus* (Grev.) Ralfs,[a] which has been figured as *Asterolampra wallichiana* Grev.[b]

Found at station 2807, Galapagos Islands.

Asteromphalus beaumontii Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 200. 1845. Jan.; Schmidt, Atlas *pl. 38. f. 6–7.* (not *f. 5*). 1876. Griff. & Henf. Micr. Dict. ed. 3. *pl. 18. f. 15.* 1875. Ratt. Proc. Roy. Soc. Edinb. **16**: 658. 1889. De Toni, Syll. Alg. **2**: 1412. 1894.

Asteromphalus ralfsianus Grun. err. det. Schmidt, Atlas *pl. 38. f. 6–7* (not *f. 5*). 1876.

Much confusion exists between this species and *A. heptactis* (Breb.) Ralfs. The latter, under its synonymous name *A. ralfsianus* (Norm.) Grun., is figured by Schmidt[c] and united with figures 6 and 7 of the same plate, which should be assigned to this species. Janisch, in a note to these figures, points out this fact. De Toni[d] groups all these figures of Schmidt under *A. heptactis* (Breb.) Ralfs. The specimens found at station 2860 approach varieties of *A. hookerii* Ehrenb. as figured under its synonym *A. humboldtii* Ehrenb.,[e] and also *A. variabilis* (Grev.) Ratt. as figured under its synonym *Asterolampra variabilis* Grev.[f] and are, further, rather close to what Brun & Tempére have named *A. senectus.*[g]

Found at stations 2859, 2860, 3346, 3607, 4029H, off Washington to Bering Sea.

Asteromphalus brookei Bail. Am. Journ. Sci. II. **22**: 2. *pl. 1. f. 2.* 1856; Schmidt, Atlas *pl. 38. f. 21–23.* 1876. Pritch. Hist. Infus. ed. 4. 837. *pl. 5. f. 79.* 1861. Cleve, Bih. Sv. Vet. Akad. Handl. 1^{11}: 10. 1873. De Toni, Syll. Alg. **2**: 1412. 1894.

Asterolampra brookei Grev. Trans. Micr. Soc. Lond. n. s. **8**: 119. *pl. 4. f. 18.* 1860. Moeb. Diat.-taf. *pl. 33. f. 18.* 1890.

Actinogramma brookei Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872**: 257. 1873.

Found at stations 3361, 3604, 3607, 3635H, 3693H, 4029H, off Panama and in Bering and Okhotsk seas. At station 3604 this species is remarkably abundant.

Asteromphalus elegans Grev. Quart. Journ. Micr. Sci. **7**: 161. *pl. 7. f. 6.* 1859. Pritch. Hist. Infus. ed. 4. 837. *pl. 5. f. 87.* 1861. Schmidt, Atlas *pl. 38. f. 1–2.* 1876. Ratt. Proc. Roy. Soc. Edinb. **16**: 212. 1889. De Toni, Syll. Alg. **2**: 1413. 1894.

Asterolampra elegans Grev. Trans. Micr. Soc. Lond. n. s. **8**: 118. *pl. 4. f. 16.* 1860. Moeb. Diat.-taf. *pl. 33. f. 16.* 1890.

Actinogramma jupiter Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872**: 392. *pl. 9. f. 3.* 1873.

Actinogramma venus Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872**: 392. *pl. 9. f. 4.* 1873.

Actinogramma saturnus Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872**: 392. *pl. 9. f. 5.* 1873.

Actinogramma sol Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872**: 392. *pl. 9. f. 6.* 1873.

Asteromphalus wyvillii Castr. Rep. Voy. Chall. Bot. **2**: 134. *pl. 5. f. 6.* 1886. De Toni, Syll. Alg. **2**: 1418. 1894.

Schmidt incorrectly attributes this name to Ralfs.

Found at station 2807, Galapagos Islands.

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[a] Pritch. Hist. Infus. ed. 4. 837. 1861.

[b] Trans. Micr. Soc. Lond. n. s. **8**: *pl. 4. f. 11.* 1860. Moeb. Diat.-taf. *pl. 33. f. 11.* 1890.

[c] Atlas *pl. 38. f. 5.* 1876.

[d] Syll. Alg. **2**: 1416. 1894.

[e] Mikrog. *pl. 35A. XXI. f. 3.* 1854.

[f] Trans. Micr. Soc. Lond. n. s. **8**: *pl. 3. f. 6–8.* 1860.

[g] Mem. Soc. Phys. et Hist. Nat. Geneva 30^{9}: 17. *pl. 3. f. 2.* 1889 (cf. Schmidt, Atlas *pl. 202. f. 17.* 1896.)

Asteromphalus flabellatus (Breb.) Grev. Quart. Journ. Micr. Sci. **7**: 160 *pl. 7. f. 4–5.* 1859. Moeb. Diat.-taf. *pl. 21. f. 4–5.* 1890. Schmidt, Atlas *pl. 38. f. 10–12.* 1876. Van Heur. Synop. *pl. 127. f. 5–6.* 1881. Jan. Abh. Schles. Ges. Vaterl. Cult. **1862^2**: 13. *pl. 2B. f. 23.* 1862. Ratt. Proc. Roy. Soc. Edinb. **16**: 622. 1889. De Toni, Syll. Alg. **2**: 1414. 1894.

Spatangidium flabellatum Breb. Bull. Soc. Linn. Norm. **2**: 297. *pl. 3. f. 3.* 1857.
Spatangidium peltatum Breb. Bull. Soc. Linn. Norm. **2**: 298. *pl. 3. f. 4.* 1857.
Asterolampra flabellata Grev. Trans. Micr. Soc. Lond. n. s. **8**: 116. 1860.

Found at stations 2807, 3698, Galapagos Islands and off Honshuh Island, Japan.

Asteromphalus heptactis (Breb.) Ralfs in Pritch. Hist. Infus. ed. 4. 838. *pl. 8. f. 21.* 1861. Ratt. Proc. Roy. Soc. Edinb. **16**: 664. 1889. De Toni, Syll. Alg. **2**: 1416. 1894.

Spatangidium heptactis Breb. Bull. Soc. Linn. Norm. **2**: 296. *pl. 3. f. 2.* 1857.
Spatangidium ralfsianum Norm. Quart. Journ. Micr. Sci. **7**: 161. *pl. 7. f. 7–8.* 1859. Moeb. Diat.-taf. *pl. 21. f. 7–8.* 1890.
Asterolampra heptactis Grev. Trans. Micr. Soc. Lond. n. s. **8**: 122. 1860.
Asteromphalus ralfsianus Grun. in Schmidt, Atlas *pl. 38. f. 5* (not *f. 6–8*). 1876.

As is stated under *A. beaumontii* Ehrenb., much confusion exists between these two forms. A variety is found abundantly at stations 4505H and 4516H, having the valves rather oval than circular, similar to Ralfs's figure cited above, but with the part bisected by the narrow limb flattened to nearly a straight line and showing a fold in the valve on the left of this limb. This contorted phase is perfectly uniform in these gatherings.

Found at stations 2807, 2923, 3604, 4505H, 4516H, Galapagos Islands to Bering Sea.

Asteromphalus hiltonianus (Grev.) Ralfs in Pritch. Hist. Infus. ed. 4. 837. 1861. Ratt. Proc. Roy. Soc. Edinb. **16**: 661. 1889. De Toni, Syll. Alg. **2**: 1414. 1894.

Asterolampra hiltoniana Grev. Trans. Micr. Soc. Lond. n. s. **8**: 117. *pl. 4. f. 15.* 1860. Moeb. Diat.-taf. *pl. 33. f. 15.* 1890. H. L. Smith, Sp. Diat. Typ. no. 491. 1878.

I have not placed the above as a synonym of *A. elegans* Grev., but the two are enough alike to raise the question of uniting them. I find both in some abundance in the same dredging, station 2807, and the distinguishing between the two has been a rather arbitrary one on my part. It may be found best to place this species under the older one, *A. elegans*.

Found at station 2807, Galapagos Island.

Asteromphalus hookerii Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 200. *f. 3.* 1845; Mikrog. *pl. 35A. XXI. f. 2.* 1854. Pritch. Hist. Infus. ed. 4, 836. *pl. 11. f. 34.* 1861. Ratt. Proc. Roy. Soc. Edinb. **16**: 656. 1889. De Toni, Syll. Alg. **2**: 1410. 1894. Griff. & Henf. Micr. Dict. ed. 3. 81. *pl. 19. f. 2.* 1875.

Asteromphalus buchii Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 200. *f. 4.* 1845.
Asteromphalus cuvierii Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 200. *f.* 7. 1845; Mikrog. *pl. 35A. XXI. f. 1.* 1854. Jan. Abh. Schles. Ges. Vaterl. Cult. **1862^2**: 160. *pl. 2B. f. 21.* 1862.
Asteromphalus humboldtii Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 200. *f. 6.* 1845; Mikrog. *pl. 35A. XXI. f. 3.* 1854. Jan. & Rabh. in Rabh. Beitr. **1**: [4. *pl. 3. f. 11*] 1863. Schmidt, Atlas *pl. 38, f. 18–20.* 1876.
Asterolampra hookerii Grev. Trans. Micr. Soc. Lond. n. s. **8**: 114. 1860.

Ehrenberg's habit of giving separate names to specimens of the same species differing in the number of arms or divisions is responsible for the three synonyms cited above, *A. hookerii* having six rays, *A. buchii* seven rays, *A. humboldtii* eight rays, and *A. cuvierii* nine rays.

Found at station 3635H, Bering Sea.

Asteromphalus nanus Mann, sp. nov. PLATE XLV, FIGURE 4.

Valves circular, the central hyaline area or rosette unequally divided into five wedge-shaped segments by straight or slightly curved partitions, having neither forks nor angular breaks, the focus of the five segments being not in the center of the valve, but slightly nearer the side bearing the narrow limb; the wedge-shaped segment of the narrow limb smallest, constituting about 12 per cent of the central area, the two on either side larger, each about 20 per cent of the area and the remaining two largest, about 24 per cent; narrow limb sharply bent to the left, dividing the beaded compartments on either side of it into two unequal portions; of the four remaining limbs one or two slightly curved; all four stout, expanded at the ends and bearing a minute circular process at the extremity; all five limbs reaching to within one row of beading of the margin; beading fine, decreasing toward the margin; approximately regular, the slight deviation from regularity being repeated exactly in each of the pairs of compartments to the right and left of the narrow limb. The species is very abundant in the one sounding where it was discovered and is constant to its type.

Diameter of valve 0.04 to 0.06 mm.; rows of beading 13 to 15 in 0.1 mm.

Type in the U. S. National Museum, No. 590128, from station 4029H, Bering Sea, June 27, 1900; 913 fathoms, bottom of gray sand and clay.

The nearest form to this is *A. debyi* Pant.[a] It differs from the latter in the character of the beading and in the absence of septae joining the dividing lines of the wedge-shaped segments of the central rosette.

Asteromphalus roperianus (Grev.) Ralfs. in Pritch. Hist. Infus. ed. 4. 838. 1861. Schmidt, Atlas *pl. 38. f. 15.* 1876. Ratt. Proc. Roy. Soc. Edinb. **16**: 657. 1889. Castr. Rep. Voy. Chall. Bot. **2**: 133. *pl. 5. f. 3.* 1886. Schultze, Bull. Torr. Club **14**: 96. 1887. De Toni, Syll. Alg. **2**: 1411. 1894.

Asterolampra roperiana Grev. Trans. Micr. Soc. Lond. n. s. **8**: 119. *pl. 4. f. 14.* 1860. Moeb. Diat.-taf. *pl. 33. f. 14.* 1890.

Mesasterias abyssi Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872**: 392. *pl. 9. f. 7.* 1873.

Found at station 2807, Galapagos Islands.

Asteromphalus shadboltianus (Grev.) Ralfs in Pritch. Hist. Infus. ed. 4. 838. 1861. Schmidt, Atlas *pl. 38. f. 17.* 1876; *pl. 137. f. 26.* 1889. Ratt. Proc. Roy. Soc. Edinb. **16**: 656. 1889. De Toni, Syll. Alg. **2**: 1411. 1894.

Asterolampra shadboltiana Grev. Trans. Micr. Soc. Lond. n. s. **8**: 121. *pl. 4. f. 19.* 1860. Moeb. Diat.-taf. *pl. 33. f. 19.* 1890.

Found at stations 2919, 2920H, 3688H, near Hawaiian Islands and in Okhotsk Sea.

Asteromphalus van heurckii Mann, sp. nov. PLATE XLV, FIGURE 5.

Valve circular, scarcely convex, extremely delicate and translucent; radiating limbs 12; central hyaline area or rosette large, divided somewhat unequally into 12 wedge-shaped segments by tortuous partitions, the segment belonging to the narrow limb alone reaching the center of the valve and narrower than the rest; limbs straight, slender, terminating at the margin of the valve in suddenly enlarged extremities, bearing a minute process; margin narrow but evidently striated; markings of the 12 external wedge-shaped compartments very delicate, appearing under magnifications of 200 to 250 diameters to consist of delicate parallel lines concentric with the periphery of the valve, but under the highest magnification resolved into fine moniliform striae, those nearest the periphery alone parallel to it, those nearer the center becoming curved in the opposite direction—that is, with the convexity inward—the striae slightly wider apart than the width of the beading; the beading next to the limbs separating the compartments and bordering the internal convex ends of the compartments double the size of the rest of the beading, forming a single row of large beads around the outer edge of each compartment. Under low magnifications these bordering rows are alone visible, the rest of the compartments appearing to be hyaline.

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[a] Beitr. Bacill. Ung. **3**: *pl. 21. f. 305.* 1893.

Diameter of valve 0.088 mm.; striae 112 to 119 in 0.1 mm.

Type in the U. S. National Museum, No. 590129, from station 2923, off southern California, January 19, 1889; 822 fathoms, bottom of green mud.

I have named this fine species as above, not only because of my high regard for Dr. Henri Van Heurck, but also on account of its general resemblance to *Asterolampra van heurckii* Brun.[a]

Asteromphalus variabilis (Grev.) Ratt. Proc. Roy. Soc. Edinb. **16:** 655. 1889. De Toni, Syll. Alg. **2:** 1410. 1894.

Asterolampra variabilis Grev. Trans. Micr. Soc. Lond. n. s. **8:** 111. *pl. 3. f. 6–8.* 1860.

My specimen is a rather doubtful example of the above species, and, it should be added, the species itself is open to some question. The figures of Greville in the above citation are too incomplete as to the nature of the limbs and especially as to the character of the markings to make it certain that figures 7 and 8 are not both generically and specifically different from figure 6, their general aspect being that of Asterolampra, as Greville has of course named them. There is no question about figure 6 being an Asteromphalus; and Rattray is probably justified in putting this variable diatom under the above name. My form lends confirmation to this view, the segment of the central area belonging to the narrow limb, being, as in figure 6, wedge-shaped and the valve having all the characteristics of this genus. Its size, also, and the fineness of its striation correspond exactly with those data as given by Rattray.

Diameter of valve 0.113 mm.; striae 5 to 8 in 0.01 mm.

Found at station 4029H, Bering Sea.

TRIPODISCUS Ehrenb.

Tripodiscus Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1839:** 130, 159. *pl. 3. f. 6a–c.* 1841.

Tetrapodiscus Ehrenb. Ber. Akad. Wiss Berl. **1843:** 166. 1844. Kütz. Bacill. 136. *pl. 1. f. 6.* 1844.

Pentapodiscus Ehrenb. Ber. Akad. Wiss. Berl. **1843:** 166. 1844.

Podiscus Bail. Am. Journ. Sci. **46:** 137. *pl. 3. f. 1–2.* 1844.

Eupodiscus Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 73. 1845, in part.

Aulacodiscus Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 73. 1845; Mikrog. *pl. 18. f. 47.* 1854. Pritch. Hist. Infus. ed. 4. 843. *pl. 6. f. 4–5.* 1861. Char. Emend. Ratt. Journ. Roy. Micr. Soc. **8:** 337. 1888. De Toni, Syll. Alg. **2:** 1091. 1894.

The name Tripodiscus is clearly prior to the generally accepted name Aulacodiscus. It is an unfortunate name, as it applies strictly to only those specimens that have the accidental number of three processes, whereas nine-tenths of the members of the genus have from four to twenty processes. But the descriptive exactness of a name can be no criterion of its claim in taxonomy. It is, however, genuinely unfortunate that this inapt name must, according to existing rules, supplant the better and generally known name Aulacodiscus. Tripodiscus is clearly defined as a genus[b] and its type species, *T. argus*,[c] is equally definite and is unmistakably figured. On the plate it is called *T. germanicus*, but the reference to it on page 159 gives preference to *T. argus*. Bailey's name, Podiscus, is better than either of the foregoing, so far as aptness is concerned. The species *T. argus*, generally known as *Eupodiscus argus* Ehrenb., is hardly characteristic of the genus, as on account of its imperfectly radiating areolation and its double markings it represents, together with *T. (Aulacodiscus) rogersii*

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[a] Mem. Soc. Phys. et Hist. Nat. Geneva 31^1: 19. *pl. 14. f. 1.* 1891.

[b] Phys. Abh. Akad. Wiss. Berl. **1839:** 130. 1841.

[c] Op. cit. 159. *pl. 3. f. 6a–c.*

Bail., and *T.* (*Aulacodiscus*) *thumii* Schmidt, a somewhat aberrant phase of the genus, for most members of the genus have simple beading for markings, radially arranged, with a more or less pronounced hyaline central area from which hyaline lines run to the bases of the intermarginal processes. Indeed, Eupodiscus of Ehrenb. (not of Ratt.) came to represent just the aberrant phase of *T. argus*. But the differences are neither constant nor striking enough to warrant a separate genus, and Rattray, Schmidt, and others, have done rightly in uniting these with those generally called Aulacodiscus. Rattray has unwisely retained the name Eupodiscus for a group of diatoms having none of the characteristics of Ehrenberg's forms, nor containing a single species so named by him, namely, species with from one to four processes that are not protuberant horns, but more of the nature of the "ocelli" in the genus Auliscus or of the pseudonodule in Actinocyclus. The genus so framed is of doubtful value, and if it be needed, those of its members which can not be referred to Auliscus (where most of them belong) would be better placed under an entirely new generic title, rather than under the misleading name Eupodiscus. Eupodiscus Ratt. (not Ehrenb.) is therefore left out of the above synonymy.[a]

Tripodiscus affinis (Grun.) Mann.

Aulacodiscus affinis Grun.; Schmidt, Atlas *pl. 1. 34. f. 9–10.* 1876. Ratt. Journ. Roy. Micr. Soc. **8**^{1}: 359. De Toni, Syll. Alg. **2**: 1110. 1894.

Aulacodiscus chasei Pant. Beitr. Bacill. Ung. **1**: 57. *pl. 29. f. 294.* 1886.

Aulacodiscus oregonus sparsius-punctata Grun.; Schmidt, Atlas *pl. 107. f. 6*, 7 (figure unnamed). 1886.

Rattray includes in this species the unnamed figure of Schmidt's noted in the last synonym as well as Grunow's subspecies of *A. oregonus* Bail. I think this union is justified. But there seems to me more uncertainty about placing here the type and varieties of *A. lunyacsekii* Pant.[b] However, there is a similarity between these and the above, and indeed between all these and *A. oregonus* Bail.

Found at Station 3604H, off British Columbia.

Tripodiscus beringensis Mann. PLATE L, FIGURE 6.

Valve circular, strongly marked with coarse beads, becoming smaller only near the margin; processes nine, submarginal; from the base of each a hyaline rectangular space, two rows of beads wide, extending radially inward for about one-fifth the radius, from this point a single row of beads running to the small circular central area, this inclosed by a ring formed of the nine terminal beads of these rows; the segments subtended by these nine radial rows set with beads of equal size in parallel lines, only the central one in each segment being, therefore, radial.

Diameter of valve 0.063 mm.; beads 64 in 0.1 mm.

Type in the U. S. National Museum, No. 590130, from Station 4029H, Bering Sea, June 27, 1900; 913 fathoms, bottom of gray sand and clay.

Tripodiscus concentricus Mann, sp. nov. PLATE LIV, FIGURES 1, 2.

Valve circular, nearly flat for one-half the radius, thence moderately and evenly convex to the margin; marking of large beads, of uniform size until within one-fifth a radius length of the margin, then of smaller beading, so placed as to form a single spiral about the minute hyaline center, thence passing into a series of strictly concentric circles and the component beads of each circle so arranged as to form with those in the other circles perfectly radial rows, the beads set slightly closer in the concentric circles than in the radiating rows; at the distance of one-half a radius from the center, where the valve becomes convex to the margin, the two concentric circles of beads a trifle farther apart than elsewhere, giving to the interspace the appearance of a bright narrow ring; processes two or three, stout, spherical, placed at about one-sixth a radius from the margin; the base of each surrounded by a small hyaline area, from which an obscure hyaline line extends to the center; border very narrow, minutely beaded.

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[a] Cf. Journ. Roy. Micr. Soc. **8**^{2}: 900. 1888.

[b] Pant. Beitr. Bacill. Ung. **1**: 59. *pl. 1. f. 2*, *pl. 2. f. 9–10*, *pl. 25. f. 225–229.* 1886.

Diameter of valve 0.065 to 0.133 mm.

Type in the U. S. National Museum, No. 590131, from station 4505H, Santa Cruz Light-house, Monterey Bay, Cal., 1904; 10 fathoms.

The concentric beading of this species reminds one of *A. brownii* Norm., though it is much more pronounced here. The species differs from *A. brownii* in the convexity of the valve, the character of the processes, the border, etc. The latter is also a much more delicate species than this massive one.

Although Rattray has used the above specific name for an Actinocyclus, I have applied it here because it is so aptly descriptive of this diatom's most striking characteristic.

Tripodiscus cosmiodiscus Mann, sp. nov. PLATE LIV, FIGURE 4.

Valve circular, nearly flat, beaded; beading minute, closely and evenly set in radiating lines, except where these lines are slightly bowed around the twelve somewhat protuberant portions of the valve bearing the twelve processes; no hyaline central area; margin obscure; each of the twelve processes consisting of a prolongation of a single row of beads, this within one-sixth a radius of the margin becoming a narrow hyaline ridge crowning the twelve slightly protuberant portions of the valve and terminating in an exceedingly small but evidently spherical process. Aspect of the valve somewhat like Greville's *Cosmiodiscus barbadensis.*[a]

Diameter of valve, 0.095 mm.; beads 130 to 135 in 0.1 mm.

Type in the U. S. National Museum, No. 590132, from station 4029H, Bering Sea, June 27, 1900; 913 fathoms, bottom of gray sand and clay.

Tripodiscus kinkeri (Schmidt) Mann.

Aulacodiscus kinkeri Schmidt, Atlas *pl. 106. f. 4-5.* 1886.

Aulacodiscus margaritaceus kinkeri Ratt. Journ. Roy. Micr. Soc. **8**^{1}: 352. 1888.

The dominant form of the present genus is probably to be seen in *A. margaritaceus* Ralfs; and under that specific name Rattray has grouped a host of forms considered as separate species by other authors.[b] This condensation was much needed, and has been well done. But in a few instances it seems to have been carried too far. The above case is an example. Schmidt's species has a strong general resemblance to both *A. margaritaceus* Ralfs and *A. crux* Ehrenb.; but I think to make it a variety is hardly justified. Schmidt's form is a far flatter specimen than Ralfs's species. As the difference between varieties and species is practically a thing of personal opinion, the recognition of Schmidt's species is simply an expression of the fact that I look upon it as a justified expedient for distinguishing between this form and others that are called *A. margaritaceus* Ralfs. It may not be out of place here to add that the multiplication of named varieties is, I think, to be avoided wherever possible. As a rule if a new form is so different from an already existing species as to require taxonomic recognition, it is safe to look upon it as a new species. The gradations of the diatoms are almost limitless, and named varieties can be multiplied ad libitum. In this work I have omitted these whenever possible and have added none to the list myself. The remarks on this subject by Rev. William Smith[c] are worthy of consideration.

Found at station 3696, off Honshu Island, Japan.

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[a] Trans. Micr. Soc. Lond. n. s. **14**: 79. *pl. 8. f. 12.* **1866.**

[b] Journ. Roy. Micr. Soc. **8**^{1}: 351. 1888.

[c] Quart. Journ. Micr. Sci. **3**: 130–135. **1855.**

Tripodiscus laxus Mann, sp. nov. PLATE LIV, FIGURE 3.

Valve circular; barely concave to the bases of the processes, thence rapidly convex to the border; processes five, auriculate, placed one-sixth of a radius from the border, their bases surrounded by evident hyaline areas; central area circular, slightly rugose, one-tenth of a radius in diameter; beading all of one size; that is, not decreasing toward the border; the rows radial and straight except at the bases of the processes, where one row on each side is curved about the base; both primary and secondary rows set wide apart with large interspaces, at least the width of two beads, generally of four beads, giving a loose and open appearance to the valve; border narrow, closely set with delicate beads.

Diameter of valve, 0.076 mm.; beads 45 in 0.1 mm.

Type in the U. S. National Museum, No. 590133, from station 4029H, Bering Sea, June 27, 1900; 913 fathoms, bottom of gray sand and clay.

The nearest approach to the above is the unnamed figure of Schmidt's,[a] which may be a variety of this species. Both bear some resemblance to *A. kilkellyanus* Grev.,[b] but the processes, the border, and the radially decreasing beading of Greville's diatom clearly distinguish it from this.

Tripodiscus margaritaceus (Ralfs) Mann.

Aulacodiscus margaritaceus Ralfs in Pritch. Hist. Infus. ed. 4. 844. 1861. Schmidt, Atlas *pl. 37. f. 4-7.* 1876; *pl. 92. f. 12.* 1886; *pl. 104. f. 6-8, pl. 105. f. 1-2, 4.* 1886. Ratt. Journ. Roy. Micr. Soc. **8**^{1}: 351-353. *pl. 6. f. 3.* 1888. De Toni, Syll. Alg. **2**: 1101. 1894.

Aulacodiscus crux Ehrenb. Mikrog. *pl. 35 A. XVI. f. 2.* 1854, in part. Grun. Denkschr. Akad. Wien **48**^{2}: 69. 1884. Schmidt, Atlas *pl. 33. f. 1-2.* 1876; *pl. 102. f. 4.* 1886.

Aulacodiscus mölleri Grun.; Schmidt, Atlas *pl. 33. f. 14, pl. 35. f. 6, pl. 37. f. 8, pl. 41. f. 12.* 1876; *pl. 102. f. 1-2, 13.* 1886.

Aulacodiscus debyi Pant. Beitr. Bacill. Ung. **1**: 58. *pl. 25. f. 226.* 1886.

Aulacodiscus n. sp.? Schmidt, Atlas *pl. 37. f. 1 3.* 1876.

Rattray[b] has named many varieties of this species. The one he calls variety *elongata* Schmidt thinks should be a separate species. (See last synonym above.) Rattray's view is to be preferred.

Found at station 2823, Gulf of California.

Tripodiscus oregonus (Harv. & Bail.) Mann.

Aulacodiscus oregonus Harv. & Bail. Proc. Acad. Phila. **6**: 430. 1854. Pritch. Hist. Infus. ed. 4. 845. *pl. 6. f. 4.* 1861. Grev. Quart. Journ. Micr. Sci. **7**: 156. *pl. 7. f. 2.* 1859. Moeb. Diat.-taf. *pl. 21. f. 2.* 1890. Schmidt, Atlas *pl. 34. f. 4-6.* 1876; *pl. 107. f. 6 7.* 1886. Ratt. Journ. Roy. Micr. Soc. **8**^{1}: 358. 1888. De Toni, Syll. Alg. **2**: 1109. 1894.

Aulacodiscus oregonensis Bail. & Harv. in Wilkes U. S. Explor. Exped. **17**: 176. 1874.

Found at station 2835, off Lower California.

Tripodiscus orientalis (Grev.) Mann.

Aulacodiscus orientalis Grev. Trans. Micr. Soc. Lond. n. s. **12**: 12. *pl. 2. f. 6.* 1864. Schmidt, Atlas *pl. 34. f. 1 3.* 1876. Grun. in Fenzl, Reise Novara Bot. **1**: 103. 1870. Ratt. Journ. Roy. Micr. Soc. **8**^{1}: 361. 1888. De Toni, Syll. Alg. **2**: 1111. 1894.

Found at station 3688, Paumotu Islands.

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[a] Schmidt, Atlas *pl. 105. f. 8.* 1886.

[b] Trans. Micr. Soc. Lond. n. s. **11**: 70. *pl. 4. f. 14.* 1863.

Tripodiscus radiosus (Gr. & St.) Mann.

Aulacodiscus radiosus Gr. & St. Journ. Quek. Micr. Club II. **3**: 140. *pl. 12. f. 33.* 1887. Schmidt, Atlas *pl. 157. f. 1.* 1890. Ratt. Journ. Roy. Micr. Soc. **8**^{1}: 350. 1888. De Toni, Syll. Alg. **2**: 1101. 1894. De Toni, Notarisia 466. 1888.

The original figure cited above is so bad as to mislead identification; but the description is clear; it agrees well with Schmidt's illustration. It is a diatom of exceptional beauty.

Found at station 2808, Galapagos Islands.

Tripodiscus rogersii (Bail.) Mann.

Podiscus rogersii Bail. Am. Journ. Sci. **46**: 137. *pl. 3. f. 1-2.* 1844. Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 81. 1845.

Eupodiscus rogersii Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 81. 1845. Schmidt, Atlas *pl. 92. f. 5-6.* 1886.

Eupodiscus baileyi Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 81. 1845.

Aulacodiscus rogersii Schmidt, Atlas *pl. 107. f. 3.* 1886. Ratt. Journ. Roy. Micr. Soc. **8**^{1}: 372. 1888. De Toni, Syll. Alg. **2**: 1121. 1894.

Aulacodiscus areolatus O'Meara, Quart. Journ. Micr. Sci. n. s. **18**: 104. 1878.

Aulacodiscus thumii Schmidt, Atlas *pl. 102. f. 8.* 1886. Ratt. Journ. Roy. Micr. Soc. **8**^{1}: 374. 1888.

The above enumerated diatoms are close to *T. argus*, and form with it a group somewhat distinct from other members of the genus, especially in the matter of the double marked areolation.

Found at stations 2823, 2835, Gulf of California and off Lower California.

Tripodiscus scaber (Ralfs) Mann.

Aulacodiscus scaber Ralfs in Pritch. Hist. Infus. ed. 4. 844. 1861. Schmidt, Atlas *pl. 33. f. 4-8.* 1876. Ratt. Journ. Roy. Micr. Soc. **8**^{1}: 353. 1888.

Aulacodiscus crux Ehrenb. in part; Hab. Cat. 57. 1877. Jan. Abh. Schles. Ges. Vaterl. Cult. **1861**^{2}: 161. *pl. 2. f. 1-3.* 1861; **1862**^{2}: *pl. 1A. f. 12.* 1862.

Aulacodiscus ternatus Jan. Abh. Schles. Ges. Vaterl. Cult. **1861**^{2}: 161. *pl. 2. f. 4.* 1861.

Aulacodiscus beeveriae Johnst.? Pritch. Hist. Infus. ed. 4. 844. *pl. 6. f. 5.* 1861. Schmidt, Atlas *pl. 36. f. 12.* 1876.

There is a possible doubt about the last-named synonym, though I do not see how it can be maintained as the name of a separate species. Strictly type forms of the present species occur in the latter of the two stations following.

Found at stations 2807, 2835, Galapagos Islands and off Lower California.

Tripodiscus tripartitus (Br. & Temp.) Mann.

Aulacodiscus tripartitus Br. & Temp. Mem. Soc. Phys. et. Hist. Nat. Geneva **30**^{9}: 21. *pl. 4. f. 3.* 1889. Schmidt, Atlas *pl. 169. f. 8, 9.* 1892. De Toni, Syll. Alg. **2**: 1106. 1894.

I assign my specimen to this species with considerable doubt. It agrees well with Schmidt's figures, but these and my form are somewhat different from the type as described and figured by its authors, especially in the absence of the inner triangular line of spines or granulations connecting the bases of the three processes.

Found at station 4029H, Bering Sea.

AULISCUS Ehrenb.

Auliscus Ehrenb. Ber. Akad. Wiss. Berl. **1843**: 270. 1844. Bail. Smithson. Contr. Knowl. **7**: 4. 1854. Ratt. Journ. Roy. Micr. Soc. **8**^{2}: 861-900. 1888. De Toni, Syll. Alg. **2**: 1025. 1894.

Mastodiscus Bail. Smithson. Contr. Knowl. **7**: 4. 1854, no species given.

Coscinodiscus Ehrenb. Ber. Akad. Wiss. Berl. **1843**: 271. 1844, in part.

Eupodiscus Ehrenb. in part; W. Smith, Synop. Brit. Diat. **1**: 25. *pl. 4. f. 39.* 1853. Bright. Quart. Journ. Micr. Sci. **8**: 94. *pl. 5. f. 3.* 1860.

Pseudoauliscus Leud.-Fort. in part; Grev. Trans. Mic. Soc. Lond. n. s. **11**: 74. *pl. 5. f. 23.* 1863.

Cerataulus Ehrenb. in part; Jan. Abh. Schles. Ges. Vaterl. Cult. **1861**^{2}: 15. *pl. 1. f. 6.* 1861.

Auliscus caelatus Bail. Smithson. Contr. Knowl. **7**: 6. *pl. 1. f. 3–4.* 1854. Grev. Trans. Micr. Soc. Lond. n. s. **11**: 44. *pl. 2. f. 4–7.* 1863. Moeb. Diat.-taf. *pl. 50. f. 4–7.* 1890. Schmidt, Atlas *pl. 32. f. 12–20, 23–26.* 1875; *pl. 67. f. 11–13.* 1881; *pl. 204. f. 21.* 1896. Pant. Beitr. Bacill. Ung. **1**: 57. *pl. 19. f. 173; pl. 28. f. 279.* 1886. Ratt. Journ. Roy. Micr. Soc. **8**^{2}: 885–888. *pl. 15. f. 5–9, pl. 16. f. 3, 6.* 1888. Pritch. Hist. Infus. ed. 4. 845. 1861. Leud.-Fort. Mem. Soc. Emul. St. Brieuc 63. *pl. 7. f. 68.* 1879. Wolle, Diat. N. A. *pl. 89. f. 6, 9–10.* 1890. H. L. Smith, Sp. Diat. Typ. 54. 1874. De Toni, Syll. Alg. **2**: 1049. 1894.

Auliscus smithii Jan. Abh. Schles. Ges. Vaterl. Cult. **1861**^{2}: 163. *pl. 2. f. 9.* 1861.

Auliscus gregorii Jan. Abh. Schles. Ges. Vaterl. Cult. **1861**^{2}: 163. *pl. 2. f. 12.* 1861.

Auliscus sculptus Ralfs, in part; Leud.-Fort. Mem. Soc. Emul. St. Brieuc *pl. 7. f. 66–67.* 1879.

This species exhibits more variability in its markings than most other members of Auliscus, a genus which I think shows a greater elasticity in this respect than any other. This has created a strong temptation to multiply named and accredited varieties, so that the species is quite confused with them. De Toni[a] enumerates fifteen such, of which Rattray is the author of eight. Did the present writer favor this method of extending nomenclature he could greatly enlarge this list out of the large mass of individuals of this species afforded by these investigations. Thus a number of very striking varieties, with feathery instead of anastomosing lines, were found at stations 2920II and 3712H –the variety called *strigillata* at station 2807 and that called *latecostata* at station 2835 and others. The fact is that Bailey's type form is not at all typical of the diatoms at present assigned to this species, but represents a rather extreme and severe phase of ornamentation only rarely met with. The significance of the specific name, *caelatus*, meaning carved, is therefore not particularly applicable, however well it applied to the original specimens. Although *A. pruinosus* Bail. is typically a very different diatom from this species, the two have come closely to approach each other by reason of the varieties assigned to them; and on the other side this species passes imperceptibly into *A. sculptus* (W. Smith) Ralfs.

Found at stations 2807, 2835, 2920II, 3712H, Galapagos Islands, to Lower California, Hawaiian Islands, and Okhotsk Sea.

Auliscus hardmanianus Grev. Trans. Micr. Soc. Lond. n. s. **14**: 6. *pl. 2. f. 17.* 1866. Moeb. Diat.-taf. *pl. 71. f. 17.* 1890. Schmidt, Atlas *pl. 67. f. 1.* 1881; *pl. 108. f. 1.* 1886. Truan & Witt, Diat. Hayti, 12. *pl. 2. f. 4.* 1888. Ratt. Journ. Roy. Micr. Soc. **8**^{2}: 17–18. 1888. De Toni, Syll. Alg. **2**: 1041. 1894.

Auliscus joynsonii Schmidt, Atlas *pl. 67. f. 2.* 1881.

Rattray gives also four named varieties. The *A. joynsonii* of Schmidt is an unimportant variety.

Found at station 2807, Galapagos Islands.

Auliscus insignis Cleve, Sv. Vet. Akad. Handl. **18**^{5}: 22. *pl. 5. f. 64a–b.* 1881. Schmidt, Atlas *pl. 89. f. 1.* 1886. Ratt. Journ. Roy. Micr. Soc. **8**^{2}: 15. 1888. De Toni, Syll. Alg. **2**: 1039. 1894.

Both the above illustrations are very poor. Cleve's material, like my own, was from the Galapagos Islands.

Found at station 2807, Galapagos Islands.

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[a] Syll. Alg. **2**: 1049. 1894.

Auliscus pruinosus Bail. Smithson. Contr. Knowl. **7:** 5. *pl. 1. f. 5-8.* 1854. Grev. Trans. Micr. Soc. Lond. n. s. **11:** 48. *pl. 3. f. 13.* 1863. H. L. Smith, Sp. Diat. Typ. 706. 1874. Pritch. Hist. Infus. ed. 4. 845. *pl. 6. f. 1.* 1861. Schmidt, Atlas *pl. 31. f. 6-7, 11, 13-15, pl. 32. f. 5.* 1875; *pl. 108. f. 10.* 1886. Ratt. Journ. Roy. Micr. Soc. 8^{2}: 22. 1888. De Toni, Syll. Alg. **2:** 1045. 1894. Moeb. Diat.-taf. *pl. 51. f. 13.* 1890.

Auliscus punctatus Bail. Smithson. Contr. Knowl. **7:** 5. *pl. 1. f. 9.* 1854. Grev. Trans. Micr. Soc. Lond. n. s. **11:** 49. *pl. 3. f. 15.* 1863. Moeb. Diat.-taf. *pl. 51. f. 15.* 1890. Schmidt, Atlas *pl. 31. f. 8.* 1875; *pl. 67. f. 7-8.* 1881; *pl. 89. f. 14-17 pl. 108. f. 10.* 1886. Ratt. Journ. Roy. Micr. Soc. 8^{2}: 9. 1888. De Toni, Syll. Alg. **2:** 1033. 1894.

There is great confusion between these two species of Bailey. The original type forms, as can be seen by comparing the figures of Bailey or those of Greyille, show considerable contrast; but at the present time one might as well assign a newly found example to one species as to the other. Rattray has retained the two species, though placing examples of *A. pruinosus*[a] under *A. punctatus.* The two species have no distinct boundary. In the single dredging in which these forms were found they are very abundant and supply every gradation between the two. It is to be noted, also, that Bailey was in considerable doubt over the separateness of these species, and it seems to me they are much better united. Nothing can better illustrate the uselessness of trying to assign specimens to one as against the other than a comparison of the two figures lying side by side in Schmidt's Atlas, plate 31, figures 7 and 8, named, despite their identity, "*pruinosus*" and "*punctatus,*" respectively. No wonder that two such capable diatomists as Grunow and Witt should call the one *pruinosus* and the other *punctatus*, the diatom represented by plate 108, figure 10, of Schmidt's Atlas.

Found at station 2807, Galapagos Islands.

Auliscus stockhardtii Jan. Abh. Schles. Ges. Vaterl. Cult. $\mathbf{1861}^{2}$: 163. *pl. 1. f. 4.* 1861. Schmidt, Atlas *pl. 30. f. 11-13.* 1875; *pl. 67. f. 6.* 1881. Ratt. Journ. Roy. Micr. Soc. 8^{2}: 7. 1888. De Toni, Syll. Alg. **2:** 1031. 1894.

Auliscus constellatus Mills, Journ. Roy. Micr. Soc. II. **1:** 867. *pl. 11. f. 2-3.* 1881.

Auliscus racemosus Ralfs, Trans. Micr. Soc. Lond. n. s. **11:** 46. *pl. 2. f. 9.* 1863. Schmidt, Atlas *pl. 67. f. 6.* note. 1881. Moeb. Diat.-taf. *pl. 50. f. 9.* 1890.

I am in doubt as to making *A racemosus* Ralfs a synonym of the above as Schmidt and Rattray have done. At least, a comparison of the original figure of Janisch with that of Ralfs in the citations given above will show enough divergence to make the matter questionable. Certain varieties of *A. pruinosus* Bail. approach this species.

Found at station 2807, Galapagos Islands.

RHIZOSOLENIA Ehrenb.

Rhizosolenia Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**; 329, 422. 1843; Ber. Akad. Wiss. Berl. **1844**: 204. 1845. Kütz. Bacill. 51. 1844; Sp. Alg. 24. 1849. Bright. Quart. Journ. Micr. Sci. **6:** 93. *pl. 5.* 1858, char. emend. Pritch. Hist. Infus. ed. 4. 865. 1861. Van Heur. Synop. 194. *pl. 78-79.* 1881; Treat. Diat. 413. *f. 133.* 1896. Griff. & Henf. Micr. Dict. ed. 4. 657. *pl. 51. f. 25.* 1883. De Toni, Syll. Alg. **2:** 823. 1894. Eng. & Pr. Pflanzenfam. 1^{1b} 84. *f. 139-140.* 1896. Perag. Le Diatomiste **1:** 108. *pl. 1-5.* 1892.

Eucampia Stolter, Journ. Roy. Micr. Soc. **2:** 835. *f. a-d.* 1879, not Ehrenb.

Attheya West, Trans. Micr. Soc. Lond. n. s. **8:** 152. *pl. 7. f. 15.* 1860. De Toni, Syll. Alg. **2:** 770, 822. 1892-94. Perag. Le Diatomiste **1:** 105. *pl. 1. f. 14.* 1892. Van Heur. Treat. Diat. 420. *f. 138.* 1896. Eng. & Pr. Pflanzenfam. 1^{1b}: 88. *f. 145.* 1896.

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[a] Schmidt, Atlas *pl. 31. f. 6-9.* 1875.

Lauderia Cleve, Bih. Sv. Vet. Akad. 1^{11}: 8. *pl. 1. f. 7.* 1873. Van Heur. Treat. Diat. 418. *f. 136.* 1896. De Toni, Syll. Alg. **2**: 771. 1892. Castr. Rep. Voy. Chall. Bot. **2**: 89. *pl. 9. f. 4, 8.* 1886.

Guinardia Perag. Le Diatomiste **1**: 107. *pl. 1. f. 1–5.* 1892. Van Heur. Treat. Diat. 417. *f. 135.* 1896. De Toni, Syll. Alg. **2**: 822. 1894.

Leptocylindricus (?) Cleve, Diat. Kattegat. 2. 1889. Perag. Le Diatomiste **1**: 104. 1892. De Toni, Syll. Alg. **2**: 822. 1891. Eng. & Pr. Pflanzenfam. 1^{1b}: 84. 1896.

Dactyliosolen Castr. Rep. Voy. Chall. Bot. **2**: 75. *pl. 9. f. 7.* 1886. Perag. Le Diatomiste **1**: 104. *pl. 1. f. 6–7.* 1892. De Toni, Syll. Alg. **2**: 821. 1891. Eng. & Pr. Pflanzenfam. 1^{1b}: 83. *f. 136.* 1896.

Ehrenberg's conception of this genus was so vague that, aside from the name, its founding is mainly due to Brightwell; and the name itself loses all meaning if we remove from it the forms represented by Cleve's Lauderia. Its members are pelagic, as a class subtropical, and, with the exception of H. L. Smith's *R. eriensis*, marine. Their terminal valves, bearing one to many setae, are widely separated by a tubular zone built up of either very narrow bands or wedge-shaped pieces imbricated into a tube. The frustules thus constructed are delicate, elastic, and not densely silicified. Yet with this strong generic harmony there are differences of absorbing interest from the fact that here more than in any other genus we find variations that stand as intermediate plan structures between it and several other distinct genera. This peculiarity of Rhizosolenia has given occasion for the creation of various questionable genera enumerated above. Their affinities are most striking. The form called by West *Attheya decora* leads to the genus Chaetoceros; Guinardia, with its rudimentary mucronate scar, is close to that doubtful example of the genus Biddulphia, which Peragallo calls *Cerataulus bergonii*;[a] the species included in the invalid genus Lauderia have valves like Stephanopyxis and girdles like Striatella; those called Dactyliosolen are very suggestive of Melosira; while in *Peragalloa meridiana* Schutt we have a probable species of Chaetoceros with the zonal view of Rhizosolenia; and finally *R. stolterforthii* Perag. is amazingly like that delicate but genuine example of the genus Eucampia which Cleve has miscalled *Mölleria cornuta.*[b] It will help to make evident the impossibility of bounding these newer genera in any way that will disdistinguish them generically if we carefully compare specimens of the species enumerated, or, in the absence of these, if we contrast in plate 1 of Peragallo's Monograph[c] the following figures: *Rhizosolenia murrayana* Castr. (f. 20), and *R. stolterforthii* (f. 17) with *Guinardia flaccida* (Castr.) Perag. (f. 4); this latter (as shown in f. 3), noting the small mucronate scar, with *Cerataulus* (*Cerataulina*) *bergonii* Perag. (f. 16; again, *G. flaccida* (f. 4) with the lower frustule of *Lauderia delicatula* Perag. (f. 13). The fact is, if stress is put solely on the setae and other appendices of the terminal valves we shall have the various genera above enumerated; but if we take the entire frustule we shall have strikingly distinct but valid species of Rhizosolenia, with much more in common structurally than the differences that distinguish them.

Rhizosolenia hebetata Bail. Am. Journ. Sci. II. **22**: 5. *pl. 1. f. 18–19.* 1856. Bright. Quart. Journ. Micr. Sci. **6**: 94. *pl. 5. f. 4.* 1858. Pritch. Hist. Infus. ed. 4. 866. 1861. Cleve, in Nordensk. Vega Exped. **3**: 486. *pl. 38. f. 69a–f.* 1883. H. L. Smith, Sp. Diat. Typ. no. 448. 1874. Grun. Denkschr. Akad. Wien $\mathbf{48}^2$: 96. *pl. 5. f. 48–50.* 1884. De Toni, Syll. Alg. **2**: 829. 1894. Perag. Le Diatomiste **1**: 114. *pl. 5. f. 10.* 1892. Moeb. Diat.-taf. *pl. 14. f. 4.* 1890.

This may be considered the type diatom of Bering Strait and the adjacent arctic waters. Bailey's original specimens came from Kamchatka, Grunow's also, and nearly every one of the following long list of dredgings and soundings were taken along the coasts of Alaska and Kamchatka. At stations 3569H and 3671H it is the commonest of all forms, and in the latter it makes up 5 to 10 per cent of the diatomaceous mass. It is important here to notice that of the thirty-three gatherings found to contain this diatom twenty-nine were hydrographic soundings and only four dredgings. It is evident that the method of taking the hydrographic soundings as contrasted with that of the regular dredgings explains why these exceedingly light and buoyant forms are abundant in one class of gatherings and not in the other. The four dredgings were taken in Arctic waters and yet contained very few specimens, while many dredgings made where this species is shown to be abundant show no trace of them. It is a clear illustration of the necessity of employing more careful methods for collecting diatoms in connection with the other marine work of the United States Fish Commission, a subject discussed in the introduction to this report.

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[a] Le Diatomiste **1**: *pl. 1. f. 3, 16.* 1892.

[b] Van Heur. Treat. Diat. 461. *f. 192.* 1896.

[c] Le Diatomiste **1**: *pl. 1.* 1892.

Found at stations 2287H, 3267H, 3361H, 3399H, 3565H, 3568H, 3569H, 3603, 3604H, 3607, 3611, 3635H, 3663H, 3669H, 3671H, 3683H, 3684H, 3691H, 3692H, 3693H, 3699H, 3704H, 3784, 3786H, 4013H, 4014H, 4019H, 4022H, 4023H, 4024H, 4025H, 4027H, 4028H, Bering Sea and Okhotsk Sea to Honshu Island, Japan.

Rhizosolenia robusta Norm.; Pritch. Hist. Infus. ed. 4. 866. *pl. 8. f. 42.* 1861. De Toni, Syll. Alg. **2**: 824. 1894. Perag. Le Diatomiste **1**: 109. *pl. 2. f. 1–1a, pl. 3. f. 1–3.* 1892. Castr. Rep. Voy. Chall. Bot. **2**: 73. *pl. 24. f. 5.* 1886. Cleve, Bih. Sv. Vet. Akad. Handl. 1^{11}: 11. 1873. Brun & Temp. Mem. Soc. Phys. et Hist. Nat. Geneva $\mathbf{30}^{9}$: 73. 1889. Van Heur. Treat. Diat. 414. *pl. 33. f. 883.* 1896.

Though the beautiful iridescent ends are abundant in the following dredgings, no complete frustule was found and very rarely a trace of the disintegrated bands composing the tube. Although large, this pellucid diatom if badly described by its specific name, *robusta*.

Found at stations 2919, 2923, 2929, 3611, 4516H, Bering Sea and off southern and Lower California.

CHAETOCEROS Ehrenb.

Chaetoceros Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 198. 1845. Van Heur. Synop. 195. *pl. 81–82.* 1881–5. Rabh. Fl. Alg. Eur. **1**: 31, 321. *f. 91.* 1864. Pritch. Hist. Infus. ed. 4. 861. 1861. Bright. Quart. Journ. Micr. Sci. **4**: 105. *pl.* 7. 1856.

Bacteriastrum Shadb. Trans. Micr. Soc. Lond. n. s. **2**: 14. 1854. Pritch. Hist. Infus. ed. 4: 863. 1861.

Hercotheca Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 262, 269. 1845; Mikrog. *pl. 33. XVIII. f.* 7. 1845.

Periptera Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 270. 1845; Mikrog. *pl. 33. XVIII. f. 9.* 1854. Pritch. Hist. Infus. ed. 4. 865. 1861.

Actiniscus Ehrenb. Ber. Akad. Wiss. Berl. **1854**: 237. 1855, in part.

Goniothecium Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 82. 1845.

Dicladia Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 73, 79. 1845.

Syndendrium Ehrenb. Ber. Akad. Wiss. Berl. **1845**: 73, 155. 1846.

Skeletonema Grun. Van Heur. Synop. *pl. 83ter f. 5.* 1881, not Grev. 1865.

Peragallia Schütt, Ber. Deut. Bot. Ges. **13**: 48. *pl. 5. f. 28a–b.* 1895?.

This genus has occasioned great confusion in the nomenclature of the Diatomaceae by reason of the peculiar mode of its growth. It is a mainly or perhaps wholly pelagic form and is found in both the living and fossil state. It grows in long filaments, the single frustules of which often vary widely, especially in respect to the character of the processes or setae that adorn them. These may be, in some few instances, wholly lacking, may proceed from opposite sides of the zonal portions, or may encircle the same. The terminal valves are generally ornamented with processes quite different from those on the intermediate frustules. Still further to complicate the matter, the separate valves contain internal secondary cases, round or oval in contour, with both valves alike or different; in some instances hyaline and in others variously sculptured, without processes or variously ornamented with spines and otherwise. These internal cases have as a class thicker siliceous walls than the external valves and girdles which inclose them, and consequently are frequently met with in sea dredgings, and especially in fossil deposits where all traces of the external walls that gave form to the complete filaments have been lost. As these various parts have been successively found they have received separate generic and specific names, and we therefore have to deal with a tangle of nomenclature unusual even among the Diatomaceae. The generic name first to be constituted and (subsequently) applied to these forms is Actiniscus. Because of its priority Grunow[a] gives it to the form known elsewhere as *Bacteriastrum varians* Laud. This name, however, was not originally applied to a diatom, but to a stellate silicious spicule, which Ehrenberg called *Dictyocha* (*Actiniscus*) *sirius*.[b] and was not used for the diatoms until 1855[c] (*A. quinarius* Ehrenb.[d] being indeterminate, but probably also a spicule). It is therefore not available for the Diatomaceae, but must give place to Chaetoceros, 1845. In this connection I wish to call attention to a quotation from Van Heurck's Synopsis given below under *Chaetoceros furcatus*. In the above list of synonyms "in part" we find Dicladia and Goniothecium, bestowed like Chaetoceros and preceding it in that volume. I am, however, opposed to accepting any of these names for the following reasons: (1) They represent what are not necessarily structural parts of the plants, Castracane,[e] holding them to be sporangial encasements; (2) we are not even able to affirm that these spicules are confined to what we know as the Chaetocerae; (3) both the above generic names were based on fossil fragments from which we can build no conception of the forms to which they belong, and in using them we should, therefore, be constituting a genus without any fixed idea of its structure. Dicladia was found in African guano and Goniothecium in diatomaceous earth from Richmond, Virginia.[f]

I can not follow Castracane in maintaining the separateness of Chaetoceros and Bacteriastrum, as his grounds of distinction[g] appear to be trivial. They are (1) that the valves of Bacteriastrum are round and of Chaetoceros generally oval; (2) that the former have more awns or setae than the latter; (3) that these are in Bacteriastrum arranged around the valve, but in Chaetoceros on opposite sides; (4) that these awns in Chaetoceros interlace. Anyone who will examine a gathering of *Bacteriastrum varians* Laud. will see that these characters are in different parts of the same filament too inconstant to form a generic concept. Thus, in H. L. Smith's type no. 57, both round and oval valves are seen in the same filament and bearing precisely the same kind of setae. Again, the terminal valves often have two setae, while those below them may have more; and in the case of Lauder's figures of this species[h] we find terminal valves with eight setae and the intermediate ones with many more. As to the interlacing of the setae, it is by no means constant, many specimens examined showing no such tendency. In fact, that condition is hardly to be discovered in Castracane's own figure.[i]

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[a] Van Heur. Synop. *pl. 82bis. f. 10.* 1881.

[b] Phys. Abh. Akad. Wiss. Berl. **1839:** 149–150. 1841. Cf. Mikrog. *pl. 18. f. 59–60.*

[c] Ber. Akad. Wiss. Berl. **1854:** 237. 1855.

[d] Ber. Akad. Wiss. Berl. **1844:** 76. 1845. cf. also Griff. & Henf. Micr. Dict. ed. 3. *pl. 43. f. 1–6.* 1875.

[e] Castr. Rep. Voy. Chall. Bot. **2:** 81. 1886.

[f] Cf. article by Brightwell in Quart. Journ. Micr. Sci. **4:** 106. 1856.

[g] Castr. op. cit. 82.

[h] Trans. Micr. Soc. Lond. n. s. **12:** *pl. 3.* 1864.

[i] Castr. op. cit. *pl. 19. f. 8.*

The interesting form constituting the genus Peragallia Schütt, does, as its author says, hint of transition between the present genus and Rhizosolenia Ehrenb., as its valves are true Chaetoceros type, while the zonal part shows the plicate bands of Rhizosolenia. But this latter portion, the zone, is liable to show various changes in many genera[a] and is hardly of enough importance to separate this otherwise normal Chaetoceros from the genus.[b]

The following genera I have not included in the above. Some of them are plainly distinct from it, as Skeletonema Grev. (not Grun.) and Strangulonema Grev. Others, like Syringidium and Pterotheca, though showing considerable resemblance to the internal cases of Chaetoceros, are as yet too imperfectly understood to warrant any safe conclusion. See Syringidium Ehrenb.,[c] Omphalotheca Ehrenb.,[d] Pyxilla Grev.,[e] Pterotheca Grun.,[f] Stephanogonia Ehrenb.,[g] Skeletonema Grev.,[h] Strangulonema Grev.,[i] Xanthiopyxis Ehrenb.,[j] and Corethron Castr.[k]

Chaetoceros coarctatus Laud. Trans. Micr. Soc. Lond. n. s. **12:** 79. *pl. 8. f. 6.* 1864. Cleve, Bih. Sv. Vet. Akad. Handl. **1^{11}:** 9. *pl. 2. f. 10.* 1873. De Toni, Syll. Alg. **2:** 996. 1894.

This is variously spelled *coarctatus* by De Toni, *coarctata* by Lauder, *coarctatum* by Cleve. The first is correct.

Found at station 4029H, Bering Sea.

Chaetoceros didymus Ehrenb. Ber. Akad. Wiss. Berl. **1845:** 75. 1846; Mikrog. *pl. 35A. XVII. f. 5, pl. 18. f. 4.* 1854. Bright. Quart. Journ. Micr. Sci. **4:** 107. *pl. 7. f. 3–7.* 1856. Jan. Abh. Schles Ges. Vaterl. Cult. **1862:** *pl. 1A. f. 21, 30, 32.* 1862. Pritch. Hist. Infus. ed. 4. 862. 1861. Griff. & Henf. Micr. Dict. ed. 3. *pl. 41, f. 47.* 1875.

My specimen is a somewhat doubtful example of the above, the setae being abnormal.

Found at station 4029H, Bering Sea.

Chaetoceros furcatus (Shadb.) Mann.

Bacteriastrum furcatum Shadb. Trans. Micr. Soc. Lond. n. s. **2:** 14. *pl. 1. f. 1.* 1854. Moeb. Diat.-taf. *pl. 3. f. 1.* 1890. Pritch. Hist. Infus. ed. 4. 863. *pl. 6. f. 26.* 1861.

Bacteriastrum curvatum Shadb. Trans. Micr. Soc. Lond. n. s. **2:** 14. *pl. 1. f. 2.* 1854. Moeb. Diat.-taf. *pl. 3. f. 2.* 1890. Griff. & Henf. Micr. Dict. ed. 3. *pl. 43. f. 18.* 1875.

Actiniscus sexfurcatus Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1854:** 237. 1855; Mikrog. *pl. 35B, IV. f. 15.* 1854.

Bacteriastrum varians Laud. Trans. Micr. Soc. Lond. n. s. **12:** 8. *pl. 3. f. 1–6.* 1864. H. L. Smith, Sp. Diat. Typ. no. 57. 1874; Jour. Quek. Micr. Club II. **3:** 42. *pl. 4. f. 2.* 1887. Van Heur. Synop. *pl. 80. f. 3–5.* 1881. Moeb. Diat.-taf. *pl. 56. f. 1–6.* 1890. Castr. Rep. Voy. Chall. Bot. **2:** 82, 84. *pl. 14. f. 2, pl. 19. f. 3, pl. 23. f. 1.* 1886.

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[a] Cf. Palmer & Kelley, Proc. Acad. Phila. **1900:** 465–479. 1900.

[b] Cf. Van Heurck, Treat. Diat. 419. *f. 137.* 1896.

[c] Ber. Akad. Wiss. Berl. **1845:** 357, 365. 1846; Mikrog. *pl. 35A, IX. f. 11.* 1854.

[d] Ehrenb. Mikrog. 126. *pl. 35A, IX. f. 4.* 1854.

[e] Trans. Micr. Soc. Lond. n. s. **13:** 1. *pl. 1. f. 5.* 1865.

[f] Van Heur. Synop. *pl. 83 bis. f. 10–11.* 1881.

[g] Ber. Akad. Wiss. Berl. **1844:** 264, 271. 1845.

[h] Trans. Micr. Soc. Lond. n. s. **13:** 43. *pl. 5. f. 1.* 1865.

[i] Trans. Micr. Soc. Lond. n. s. **13:** 43. *pl. 5. f. 2.* 1865.

[j] Ber. Akad. Wiss. Berl. **1844:** 264, 273. 1845; Mikrog. *pl. 33. XVII. f. 17.*

[k] Castr. Rep. Voy. Chall. Bot. **2:** 85. *pl. 21. f. 3–6, 12, 14–15.* 1886.

Actiniscus curvatus Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872**: 390. *pl. 6. II. f. 12.* 1873.

Actiniscus vicenarius Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872**: 390. *pl. 6. II. f. 11*(?). 1873.

Chaetoceros varians Van Heur. Synop. 195. 1885. De Toni, Syll. Alg. **2**: 998. 1894.

Bacteriastrum spirillum Castr. Rep. Voy. Chall. Bot. **2**: 83. *pl. 19. f. 2, pl. 29. f. 1.* 1886.

Bacteriastrum brevispinum Castr. Rep. Voy. Chall. Bot. **2**: 83. *pl. 15. f. 6, 8.* 1886.

The very appropriate specific name of Lauder must give place to that of Shadbolt. Castracane builds the specific character of his *spirillum* on the spirally wound setae, a quality not possessed, he says, by the above. This is quite contrary to the facts. His own figures of *B. varians* Laud.,[a] show this spiral quality. Or if his contention is that these are simply undulate, while his form has setae with a spirally wound thickening, this also is incorrect. *C. furcatus* shows this in many specimens most plainly. It may be added that exact duplicates of his *B. brevispinum* are found at station 3698, both having and destitute of the spiral ornamentation of the setae.

As this is the species to which belong most or all of the forms named generically Actiniscus by Ehrenberg, it may be well to here add to the reasons advanced by me under the present genus caption for rejecting Ehrenberg's name a quotation from Van Heurck[b] bearing on this point. He says: "NOTE.—Les formes pour lesquelles Ehrenberg a constitué le genre Actiniscus, n'étaient pas des Diatomées et les auteurs subséquents qui ont écrit sur ces formes n'auraient pas dû les admettre dans leur classification. Ehrenberg a rapporté le genre Bacteriastrum à son genre Actiniscus mais sans avoir aucune raison plausible et il a continué à agir ansi jusque dans son dernier ouvrage, Fortsetzung der Mikr. Studien, 1875. Toutes les formes de Bacteriastrum doivent être ramenées au genre Chaetoceros."

Found at stations 2860, 3091, 3346, 3698, 3712H, off British Columbia to Oregon and Kurile chain to Honshu Island, Japan.

Chaetoceros sp.?

Dicladia mamillana L. W. Bailey, Bost. Jour. Nat. Hist. **7**: 339. *pl. 7. f. 41-45.* 1862.

My specimens agree with figure 44 in the above, being what Bailey calls var. B.

Found at stations 4013H, 4516H, off Honshu Island, Japan, and Lower California.

Chaetoceros sp. ?

Goniothecium odontella Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 82. 1845; Mikrog. *pl. 18. f. 94, pl. 33. XIII. f. 13-14, pl. 33. XV. f. 16.* 1854. Pritch. Hist. Infus. ed. 4. 864. *pl. 6. f. 29.* 1861. Bright. Quart. Journ. Micr. Sci. **4**: 106. *pl. 7. f. 47-48.* 1856. Moeb. Diat.-taf. *pl. 8. f. 47-48.* 1890. De Toni, Syll. Alg. **2**: 1009. 1894. Witt, Verh. Russ. Min. Gesell. II. **22**: 25. *pl. 7. f. 7-8.* 1886. Van Heur. Synop. *pl. 105. f. 11-12.* 1881.

Ehrenberg found this form, together with eight others named by him, in the fossil deposit of Richmond, Virginia. Although this particular one has not so far been met with in a living state, six of the other eight have been so observed. It is therefore reasonable to assume that these peculiar structures are inner casings of certain Chaetoceros valves, the outer spine-bearing valves of which have fallen away. But it should be remembered that quite dissimilar specimens of Goniothecium may be eventually found to belong to the same species of Chaetoceros. These forms are so frequently met with and are so widely illustrated in diatom literature that I have thought it advantageous to give the above citations.

Found at station 4029H, Bering Sea.

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[a] Castr. op. cit. *pl. 14. f. 2, pl. 29. f. 8.*

[b] Van Heur. Synop. 195. 1885.

TRIGONIUM Cleve.

Trigonium Cleve, Ofv. Kgl. Vet. Akad. **24**: 663. 1868; Bih. Sv. Vet. Akad. Handl. **1**^{13}: 8. 1873.

Triceratium Ehrenb. err. det. Bail. Smithson. Contr. Knowl. **2**^{8}: 14. *f. 55–56*. 1851. Bright. Quart. Journ. Micr. Sci. **4**: 275. *pl. 17. f. 16*. 1856.

Biddulphia Gray, in part; Bright. Quart. Journ. Micr. Sci. **7**: 181. *pl. 9. f. 15*. 1859.

Zygoceros Ehrenb. in part; Bail. Smithson. Contr. Knowl. **7**: 11. *pl. 1. f. 29*. 1854.

Amphitetras Ehrenb. in part; De Toni, Syll. Alg. **2**: 900. 1894.

Amphipentas Ehrenb. in part; De Toni, Syll. Alg. **2**: 911. 1894.

Nothoceratium De Toni, Syll. Alg. **2**: 914. 1894, in part.

Cestodiscus Grev. in part; Grun. in Van Heur. Synop. *pl. 126. f. 1–2*. 1881.

Pseudotriceratium Grun. Denkschr. Akad. Wien **48**^{2}: 83. 1884.

The genus Triceratium as constituted by Ehrenberg[a] included simply triangular specimens of the genus Biddulphia Gray. The striking but inconstant characteristic led him to select the very descriptive name and to word his diagnosis so as to convey this one idea. His type species, *T. favus*, agrees with this. It is, therefore, based on a wholly untenable conception and is a synonym of Biddulphia. Gradually, however, it underwent modification chiefly at the hands of Brightwell[b] and Ralfs,[c] whereby it came to include forms with more than three horns, together with a host of forms where the horns at the angles are obscure or wanting, in fact, almost anything of a polygonal character, when seen from the valval side. It thus came about that the genus grew to be a mixture of many genera, whose sole bond of union was the worthless accident of a more or less angular valve outline. Thus polygonal specimens of Stictodiscus Grev., of Ditylum Bail., of the triangular forms of Hemiaulus Ehrenb., which make up Heiberg's invalid genus Trinacria, of the triangular forms of Terpsinoe Ehrenb., which Wallich calls Hydrosera, and others found a resting place in this unscientific medley. De Toni[d] performs the useless task of restoring it to its original boundaries, except that he excludes those triangular forms represented by Greville's newer genus Entogonia. It is evident that Triceratium Ehrenb. represents nothing but a peculiar configuration of Biddulphia; nor have the attempts to reconstruct it resulted in anything but confusion. It must, therefore, be abandoned, a course adopted by Van Heurck, Boyer, and others. But in doing this some diatoms now bearing the name Triceratium remain which can not be referred to any of the before-mentioned genera. This has led to the necessity of a genus for these forms; and I have placed them in the genus created by Cleve for this purpose. He defines it as follows: "Hufvudytan triangulär, sidoytan rektangelformig utan framspringande utskott eller hörn." It is true that this is too indefinite, as it would include such triangular and quadrangular forms as we meet with in Stictodiscus, as well as the members of the genus Entogonia, a genus that Cleve recognizes as distinct; and further would exclude the occasional biangular or fusiform specimens of some species normally triangular. But that the latter are not intended to be excluded by Cleve is shown by the fact that in discussing *Trigonium arcticum* (Bright.) Cleve[e] he speaks of the biangular variety known as *Zygoceros balaena* Ehrenb. Boyer[f] refers the members of Triceratium (exclusive of those referred to other established genera, as Stictodiscus and Hemiaulus) to Biddulphia, whether the angles are surmounted by horn-like processes or not, and to a great extent Van Heurck does the same. This takes from Biddulphia its most salient characteristic and places in the genus such diatoms as those in the following species which are in striking contrast to the Biddulphia idea. I therefore make use of Cleve's genus, excluding those triangular forms that have definite central areas distinctly different in sculpture from the rest of the valve, represented by the genus Entogonia, and including forms having four or more angles. Nothoceratium De Toni agrees in part with this, except for the limitation of the species to those of six or more angles, an utterly impracticable provision, leading to the absurd distinction between the four-sided and the six-sided specimens of *Triceratium parallelum* Grev.,[a] the former of which he places in the genus Amphitetras and the latter in Nothoceratium.

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[a] Phys. Abh. Akad. Wiss. Berl. **1839**: 129, 159. 1841.

[b] Quart. Journ. Micr. Sci. **1**: 215. 1853.

[c] Pritch. Hist. Infus. ed. 4. 853. 1861.

[d] De Toni, Notarisia **5**: 912. 1890; Syll. Alg. **2**: 917. 1894.

[e] Bih. Sv. Vet. Akad. Handl. **1**^{13}: 8. 1873.

[f] Proc. Acad. Phila. **1900**: 1901.

Trigonium alternans (Bail.) Mann.

Triceratium alternans Bail. Smithson. Contr. Knowl. **2^3**: 14. *pl. 1. f. 55–56.* 1851; **2^8**: 40. 1851. Bright. Quart. Journ. Micr. Sci. **1**: 251. *pl. 4. f. 19a–b.* 1853. Jan. Abh. Schles. Ges. Vaterl. Cult. **1862^2**: 15. *pl. 1A. f. 16.* 1862. W. Smith, Synop. Brit. Diat. **1**: 26. *pl. 5. f. 45, pl. 30. f. 45.* 1853. Schmidt, Atlas *pl. 78. f. 9–18* (not *f. 19–20*, = *T. campechianum* Grun.). 1882. O'Meara, Proc. Roy. Irish. Acad. II. **2**: 278. *pl.* 27. *f. 11.* 1875. Van Heur. Synop. *pl. 113. f. 4–5.* 1881. Pritch. Hist. Infus. ed. 4. 854. *pl. 6. f. 21.* 1861. Moeb. Diat-taf. *pl. 1. f. 19a–b.* 1890. Wolle, Diat. N. A. *pl. 100. f. 16, 18* (not *pl. 106. f. 2*). 1890. De Toni, Syll. Alg. **2**: 941. 1894.

Biddulphia alternans Van Heur. Synop. 208. 1881. Boyer, Proc. Acad. Phila. **1900**: 719. 1901.

Triceratium variabile Bright. Quart. Journ. Micr. Sci. **4**: 275. *pl. 17. f. 19a–c.* 1856. Moeb. Diat.-taf. *pl. 9. f. 19a–c.* 1890. West, Trans. Micr. Soc. Lond. n. s. **8**: 149. *pl. 7. f. 7.* 1860. Pritch. Hist. Infus. ed. 4. 854. 1861. Leud. Fort.-Mem. Soc. Emul. St. Brieuc 60. 1879.

There is a specious resemblance here to the Biddulphia type in the slight elevation of the angles and this is intensified by their being apparently cut off from the rest of the valve by definite internal septa. This is especially so if several of the figures above cited are relied on instead of the diatoms themselves. That there are no processes at the angles can be seen by a careful examination of more than one specimen of this species. Sometimes the extremities of the angles are not raised at all above the rest of the valve and in some cases they are slightly lower. The lines usually (not always) marking off the extremities and making them resemble Biddulphia processes have no significance; for in the forms classed by Brightwell, as *T. variabile*, the valves are penetrated by numerous false septa extending inward from the margin. The angles are often beaded exactly like the rest of the valve. Altogether these angular portions are very different from the true processes of Biddulphia. It may be mentioned in this connection that the frustules are not joined by alternate angles into a zigzag chain, as is common in Biddulphia, but when united, which is rare, it is face to face; but it should also be said that too much significance should not be placed on this fact, either here or elsewhere. Schmidt, De Toni, and others do not admit this species into Biddulphia, but retain it in Triceratium.

Found at station 3696, off Honshu Island, Japan.

Trigonium articum (Bright.) Cleve, Öfv. Kgl. Vet. Akad. **24**: 663. 1868; Sv. Vet. Akad. Handl. **1^{13}**: 8. 1873.

Triceratium arcticum Bright. Quart. Journ. Micr. Sci. **1**: 250. *pl. 4. f. 11.* 1853 Moeb. Diat.-taf. *pl. 1. f. 11.* 1890. Grun. in Fenzl, Reise Novara Bot. **1**: 24. 1870. De Toni, Syll. Alg. **2**: 920. 1894. Pritch. Hist. Infus. ed. 4. 856. 1861. Cleve & Grun. Sv. Vet. Akad. Handl. **17^2**: 15, 111. 1880. Schmidt, Atlas *pl. 76. f. 29, pl. 79. f. 5–6, 8, 10–13.* 1882; *pl. 81. f. 4.* 1885. H. L. Smith, Sp. Diat. Typ. no. 596. 1874. Van Heur. Synop. *pl. 112. f. 1.* 1881.

Biddulphia arctica Boyer, Proc. Acad. Phila. **1900**: 714. 1901.

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[a] Trans. Micr. Soc. Lond. n. s. **13**: 104. *pl. 9. f. 22–23.* 1865.

Biddulphia balaena Bright. Quart. Journ. Micr. Sci. **7**: 181. *pl. 9. f. 15.* 1859. Moeb. Diat.-taf. *pl. 23. f. 15.* 1890. Cleve, in Nordensk. Vega. Exped. **3**: 485. 1883. Schmidt, Atlas *pl. 121. f. 5–6.* 1888. H. L. Smith, Sp. Diat. Typ. no. 624. 1874. Boyer, Proc. Acad. Phila. **1900**: 713. 1901.

Zygoceros balaena Ehrenb. Mikrog. *pl. 35A XXXIII. f. 17.* 1854; Ber. Akad. Wiss. Berl. **1853**: 529. 1854. Roper, Trans. Micr. Soc. Lond. n. s. **7**: 20. 1859. De Toni Syll. Alg. **2**: 887. 1894.

Zygoceros radiatus Bail. Smithson. Contr. Knowl. **7**: 11. *pl. 1. f. 29.* 1854.

Amphitetras wilkesii Harv. & Bail. Proc. Acad. Phila. **6**: 430. 1854.

Triceratium formosum Bright. Quart. Journ. Micr. Sci. **4**: 274. *pl. 17. f. 8.* 1856. Moeb. Diat.-taf. *pl. 9. f. 8.* 1890.

Triceratium quadrangulare Grev. Trans. Micr. Soc. Lond. n. s. **13**: 10. *pl. 2. f. 26.* 1865. Moeb. Diat.-taf. *pl. 63. f. 26.* 1890. Schmidt, Atlas *pl. 81. f. 3.* 1885.

Amphitetras quadrangularis De Toni, Syll. Alg. **2**: 904. 1894.

Triceratium quinquelobatum Grev. Trans. Micr. Soc. Lond. n. s. **14**: 83. *pl. 9. f. 21.* 1866. Moeb. Diat.-taf. *pl. 73. f. 21.* 1890. Schmidt, Atlas *pl. 79. f. 8.* 1882. Eng. & Pr. Pflanzenfam. 1^{1b}: 91. *f. 155B.* 1896.

Amphipentas quinquelobata De Toni, Syll. Alg. **2**: 911. 1894.

Triceratium firmum Grev. Trans. Micr. Soc. Lond. n. s. **12**: 93. *pl. 13. f. 8.* 1864. Moeb. Diat.- taf. *pl. 61. f. 8.* 1890. De Toni, Syll. Alg. **2**: 924. 1894.

Biddulphia formosa Walk. & Chase, Notes on Diatoms **1**: 2. *pl. 2. f. 9.* 1886.

This species is Cleve's type of the genus Trigonium.

Probably no species shows more variability than this in size, outline, fineness of marking, and absence or presence of central area. Nor is it possible to decide on the identity of the above names without specimens corresponding to the figures and descriptions. I have been able to do this on account of the large number of sea dredgings, widely separated from each other and containing abundant quantities of these forms that have been examined for this report. By comparison of many examples accurately agreeing with the above names I am convinced they all represent varieties of the same polymorphic species, and this conclusion agrees in the main with that of some of the authors cited above. Thus *Zygoceros balaena* Ehrenb., which is *Z. radiatus* Bail., and *Biddulphia balaena* Bright., is an oval with two instead of three rounded apices. It is frequent at station 4029H. It is also in H. L. Smith's Type no. 624 and makes up a considerable portion of type no. 596, marked *Triceratium arcticum,* in which the two-angled and three-angled varieties can be seen side by side and are so absolutely alike, except in the number of angles, that no question of their specific identity can remain. One of the slides accompanying this report contains three specimens from station 3603; the first is Grunow's variety *californica,* the second a quadrate specimen of *T. arcticum*, and the third a quadrate specimen of *T. formosum.* The variety *californica* also occurs abundantly at stations 2807, 2859, 2923, 3603, 3604, 3692H; beautiful specimens of typical *T. quadrangulare* Grev., at station 3688H; *T. quinquelobatum* Grev., at station 2808; a variety close to *T. antarcticum* Jan., at stations 2807 and 3604H; *T. firmum* Grev., at station 3688H. Regarding this last the border in my specimens are not quite so massive as in Greville's drawing; but the border varies greatly in all members of this species. It is certainly a small and stout variety of this species. My specimens of it averaged 0.065 mm. in diameter. I have not included *T. antarcticum* Jan., as the identification in my specimens is not exact. It is probably also a variety. The placing of some of the above in Triceratium, others in Amphitetras and others in Amphipentas by De Toni is unaccountable; also his uniting the five-angled *T. formosum* with the five-angled *T. favus* under Brightwell's invalid name *T. grande.*

Found at stations 2680H, 2807, 2808, 2844, 2859, 2923, 3263H, 3603, 3604, 3604H, 3683H, 3688H, 3691H, 3692H, 3698, 4025H, 4029H, 4516H, Galapagos Islands to Bering Sea and south to Honshu Island, Japan

Trigonium adspersum Mann, sp. nov. PLATE LI, FIGURE 5.

Valves triangular; slightly and evenly convex; sides inflated; angles blunt, not produced, each one having an evident but very minute spine; markings large, compound, oval or rounded beads, loosely but radially placed at the middle of the valve, leaving an indefinite central area, thence outward closely set and radially arranged, remaining the same size until within a short distance of the border, then rapidly diminishing to one-fourth size.

Width between apices, 0.065 mm.

The general markings correspond to *T. rusticum* Mann, which also has very minute spines at the angles. The two are rather wide for one species. Compare this description with that of the latter below.

Type in the U. S. National Museum, No. 590157, from station 3699H, Okhotsk Sea, September 3, 1896; 1,584 fathoms, bottom of green mud and fine sand.

Trigonium cinnamomeum (Grev.) Mann.

Triceratium cinnamomeum Grev. Quart. Journ. Micr. Sci. n. s. **3**: 232. *pl. 9. f. 12.* 1863. Moeb. Diat.-taf. *pl. 47. f. 12.* 1890. Schmidt, Atlas *pl. 151. f. 23–24.* 1890. De Toni, Syll. Alg. **2**: 974. 1894.

Cestodiscus cinnamomeum Grun.; Van. Heur. Synop. *pl. 126. f. 1–2.* 1881.

Pseudotriceratium cinnamoneum Grun. Denkschr. Akad. Wien **48**^{2}: 83. 1884.

However this diatom may contrast with others by reason of the minute spines that terminate its apices, the hyaline lines leading up to these and thus bisecting the angles, and the general but not constant presence of still smaller spines along the margin, I do not recognize any reason for placing this in Cestodiscus. That genus as defined by Greville[a] is made to differ from Aulacodiscus by the absence of "furrows" or radiating lines running from the center to the submarginal processes, not in any marked difference of the processes. To confuse such processes with the minute spines of this diatom, to which "furrows" always do run, even to those occasionally present on the margin, is hardly allowable; and when we add the further character of Cestodiscus added by Castracane,[b] a submarginal band with minuter and closer granulation, any resemblance to that doubtful genus vanishes. Schmidt and others reject this classification; and Grunow subsequently proposes a new genus, Pseudotriceratium, to accommodate this species. This would be warranted, in view of the uselessness ot Triceratium, did not Cleve's older genus Trigonium serve the purpose as well.

Found at stations 2807, 2920H, Galapagos and Hawaiian Islands.

Trigonium coscinoides (Gr. & St.) Mann.

Triceratium coscinoides Gr. & St. Journ. Quek. Micr. Club II. **2**: 327. *pl. 19. f. 13.* 1886. De Toni, Syll. Alg. **2**: 922. 1894.

Triceratium radioso-reticulatum Grun.; Schmidt, Atlas *pl. 151. f. 35–36* (corrected to *T. coscinoides* in Berichtigungen opposite *pl. 153*). 1890. Van Heur. Synop. *pl. 112. f. 5.* 1881.(?).

I have been able by the discovery of numerous specimens of this diatom to determine the unity of the above. The specimens agree with the Oamaru figure except in having a very minute spine at one or all of the apices, thus agreeing with the form described by Grunow. As a rule, the tiny spine is present on only one or two of the apices, thus showing on the same valve the Grunow and the Grove and Sturt forms. I add a question-mark after the citation to Van Heurck, because no specimens I have examined show any trace of the secondary marking figured and mentioned by him, nor any very evident radial arrangement of the network, and, on the other hand, there is no mention by him of the apical spines. It is probable all these are alike, in which case the name should be *Trigonium reticulo-radiatum*. It may be added that my specimens are larger than the Grove and Sturt type, which is given as 0.0022 to 0.004 inch, approximately equal to 0.0056 to 0.01 mm., while my specimens vary from 0.048 to 0.16 mm.

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[a] Trans. Micr. Soc. Lond. n. s. **13**: 48. 1865.

[b] Castr. Rep. Voy. Chall. Bot. **2**: 122. 1886.

Found at station 4029H, Bering Sea.

Trigonium parallelum (Ehrenb.)? Mann.

Amphitetras parallela Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1839**: 143. 1841?; Mikrog. *pl. 19. f. 20a–b*. 1854.? Kütz. Bacill. 135. 1844. Pritch. Hist. Infus. ed. 4. 858. 1844. De Toni, Syll. Alg. **2**: 908. 1894.

Triceratium parallelum Ehrenb.?; Grev. Trans. Micr. Soc. Lond. n. s. **13**: 104. *pl. 9. f. 22–23*. 1865. Moeb. Diat.-taf. *pl. 69. f. 22–23*. 1890. Schmidt, Atlas *pl. 75. f. 3–5, 11–13, 30, pl. 76. f. 14–17*. 1852 (not *f. 18*); *pl. 81. f. 1–2*. 1885. Van Heur. Synop. *pl. 111. f. 2–6* (not *f. 1, 3–5*). 1881. Grun. in Fenzl, Reise Novara Bot. **1**: 24. 1870.

Triceratium obtusum Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 88. 1845; Phys. Abh. Akad. Wiss. Berl. **1841**: 425. 1843; Mikrog. *pl. 18. f. 48–49*. 1854. Pritch. Hist. Infus. ed. 4. 857. 1861.

Nothoceratium? *parallelum* De Toni, Syll. Alg. **2**: 915. 1894.

I have adopted the above specific name, as my specimen agrees with Greville's form. Whether or not this is *A. parallelum* Ehrenb. is impossible to determine. Ehrenberg simply says,[a] under *A. antediluviana*, "Vor wenig Tagen hat sich in den griechischen Kreidemergeln noch eine zweite Art dieser Gattung gefunden, welche auf den Seitenflachen parallela Reihen von Zellen hat und die als *A. parallela* abzusondern ist." Kützing simply repeats this meager mention. Ehrenberg's figures are also inconclusive but show a very different center. All this would be simply negative except for the character of *T. obtusum*, which unmistakably is the same as Greville's *T. parallelum*, the figures of Ehrenberg, together with the diagnosis, making this plain. He there says, " * * * angulis late rotundatis, subtilissime punctata." If, therefore, Ehrenberg has twice named the same species, the earlier name, *parallela*, holds; if not, the proper name for Greville's form and my own is *obtusum*. Though the chances are in favor of the latter view, they are not conclusive, and the better-known name should remain.

It is not impossible to consider this species as belonging to Stictodiscus, as Castracane[b] suggests. But at least the form with which I have to deal is a little too divergent to assign to that genus. I think the resemblance to Stictodiscus is largely in the anastomosing shadow lines at the center of the valve, an appearance lacking in my specimens. De Toni's placing the quadrate form in Amphitetras and the sextate in Nothoceratium is of course indefensible.

A few bad errors in naming figures should here be mentioned. Schmidt's Atlas, plate 76, figure 18, is not *T. parallelum*, but, as Grunow insists, *T. juncatense* Grun. Van Heurck's Synopis, plate 111, figure 1, has nothing to do with this form; those in Wolle[c] are so bad as to have no resemblance to this species, and his figures 11, 12 are poor copies of Schmidt's plate 75, figures 11, 12, themselves doubtful examples of this species. Van Heurck's plate 111, figures 3 (certainly), 4, 5 (probably), are *T. harrisonianum* Norm. (=*Stictodiscus*).[d]

Found at station 3013H, near Hawaiian Islands.

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[a] Phys. Abh. Akad. Wiss. Berl. **1839**: 143. 1841.

[b] Castr. Rep. Voy. Chall. Bot. **2**: 114. 1886.

[c] Wolle, Diat. N. A. *pl. 100*. 1890.

[d] Cf. Schmidt, Atlas *pl. 75. f. 15*. 1882.

Trigonium plano-concavum (Brun) Mann.

Triceratium plano-concavum Brun in Brun & Temp. Mem. Soc. Phys. et Hist. Nat. Geneva **30**[9]: 63. *pl. 6. f. 9.* 1889. Brun, Le Diatomiste **1**: 5. *pl. 1. f. 1.* 1890. De Toni, Syll. Alg. **2**: 929. 1894.

De Toni notes the resemblance of this species to *T. inelegans* Grev.,[a] *T. nicobaricum* Grun.,[b] and *T. juncatense* Grun.[c] The similarity exists but is slight, especially if examined with high magnification and slightly oblique light, by which means the remarkable pitting of the beads brought out in the fine photograph in Le Diatomiste is made plain.

Found at stations 3688H, 4029H, Galapagos Islands and Okhotsk Sea.

Trigonium rusticum Mann, sp. nov. PLATE LI, FIGURE 4.

Valve triangular, slightly convex; the angles extended into flat arms with slightly broadened ends; sides between the arms inflated; markings coarse, consisting of a few large scattered oval beads at the center of the valve, thence outward strictly radiating, decreasing in size to the margin, which is very narrow and most minutely beaded; a minute spine at the apex of each arm.

Width between the apices, 0.06 mm.

It resembles remotely *T. microcephalum* Grev.[d] and *T. subcapitatum* Grev.[e] but differs materially in its coarse, strongly radiating beading and especially in its flat arms destitute of the globose elevated ends found in the foregoing.

Type in the U. S. National Museum, No. 590134, from station 4029H, Bering Sea, June 27, 1900; 913 fathoms, bottom of gray sand and clay.

Trigonium sculptum (Shadb.) Mann.

Triceratium reticulum Bright. Quart. Journ. Micr. Sci. **1**: 251. *pl. 4. f. 17.* 1853 (?), not Ehrenb.

Triceratium sculptum Shadb. Trans. Micr. Soc. Lond. n. s. **4**: 15. *pl. 1. f. 4.* 1854. Moeb. Diat.-taf. *pl. 3. f. 4.* 1890. Schmidt, Atlas *pl. 76. f. 9–12, 31.* 1877, *pl. 150. f. 17.* 1890. Van Heur. Synop. *pl. 109. f. 7–8, pl. 111. f. 8.* 1881. Pritch. Hist. Infus. ed. 4. 856. 1861. Wolle, Diat. N. A. *pl. 106. f. 3–5, pl. 111. f. 4.* 1890. Petit, Fonds de la Mer **3**: 195. 1877.

Triceratium punctatum Bright. Quart. Journ. Micr. Sci. **4**: 275. *pl. 17. f. 18.* 1856. Pritch. Hist. Infus. ed. 4. 856. *pl. 6. f. 20.* 1861. De Toni, Syll. Alg. **2**: 944. 1894. H. L Smith, Sp. Diat. Typ. no. 602. 1874. Cleve, Bih. Sv. Vet. Akad. Handl. **5**[8]: 16. 1878. Van Heur. Synop. *pl. 109. f. 6, 9–10.* 1881. Wolle, Diat. N. A. *pl. 101. f. 9, 12.* 1890. Schmidt, Atlas *pl. 76. f. 19–20.* 1882; *pl. 81. f. 6–7.* 1885; *pl. 99. f. 5.* 1886. Cleve in Nordensk. Vega Exped. **3**: 503. 1883. Petit, Fonds de la Mer **3**: 194. 1877.

Biddulphia sculpta Van Heur. Synop. 208. 1885.

Triceratium pardus Schmidt, Atlas *pl. 79. f. 15.* 1882.

Biddulphia reticulum Boyer, Proc. Acad. Phila. **1900**: 724. 1901.

This species varies greatly. It is common to find in the Pacific dredgings forms with a small curved spine in the center and an evident but delicate circular ridge, centrally placed, having a radius of one-half the distance from center to side of the valve. Schmidt[f] mentions the spine, saying there are one to three in forms from Nottingham, Maryland; but he does not mention the ridge. Shadbolt gives emphasis to three minute rings near the center. These, like the ridge and spines mentioned, are inconstant. Though the union of *sculptum* and *punctatum* is desirable, the former name should be preferred to the latter, which De Toni selects. It is probable *T. reticulum* Bright. belongs here, though the miserable figure and incomplete description make this a little uncertain. But this is not *T. reticulum* Ehrenb.[a] De Toni quotes Brightwell's name but does not identify it with Ehrenberg. *T. browneanum* Grev.[b] which Boyer adds to the above list, is not at all the same. Greville says of it "angles rounded with obscure pseudonodules." These last can not possibly be the rings of Shadbolt's form, those being at the center, but must be processes at the apices. The center of Greville's figure is clearly drawn and without trace of the rings of *T. sculptum.* I think Schmidt's plate 79, figures 14 and 16, belong here, a pentagonal specimen from Station 2920H being almost identical with figure 14 as well as with Van Heurck's Synopsis, plate 109, figure 6.

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[a] Trans. Micr. Soc. Lond. n. s. **14**: 8. *pl. 2. f. 21.* 1866.

[b] Schmidt, Atlas *pl. 76. f. 22.* 1877.

[c] Schmidt, Atlas *pl. 76. f. 13.* 1877.

[d] Trans. Micr. Soc. Lond. n. s. **9**: 74. *pl. 9. f. 4.* 1861.

[e] Quart. Journ. Micr. Sci. n. s. **3**: 234. *pl. 10. f. 20.* 1863.

[f] Schmidt, Atlas *pl. 76. f. 26.* 1882.

Found at stations 2920H, 3513, 3526, 3611, 3604H, 3698, 3712H, Hawaiian Islands, Honshu Island, Japan, and Okhotsk Sea.

Trigonium striolatum (Ehrenb.) Mann.

Triceratium striolatum Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1839:** 159. *pl. 4. f. 9.* 1841. Bright. Quart. Journ. Micr. Sci. n. s. **1:** 250. *pl. 4. f. 10.* 1853. Moeb. Diat.-taf. *pl. 1. f. 10.* 1890 De Toni, Syll. Alg. **2:** 943. 1894. (not Roper, Trans. Micr. Soc. Lond. n. s. **2:** 74. *pl. 6. f. 3.* 1854.)

Roper is right[c] in claiming that his idea of this diatom of Ehrenberg and Brightwell's idea are not the same. A comparison of the original figure and a reading of Ehrenberg's diagnosis will show that Brightwell is correct. There is neither mention nor sign in the figures of any horn-like processes in Ehrenberg's species. At any rate the specimens found by me are wholly destitute of such processes, though the apices are produced; and as they agree perfectly with what is given in Ehrenberg, Kützing, and Brightwell, I look upon them as well marked and distinct from Roper's form. To unite all these with *Biddulphia rhombus* (Ehrenb.) W. Smith, as is done by Van Heurck[d] is out of the question. Roper's form is probably the same as *T. membranaceum* Bright.[e]

Found at station 3361H, Bering Sea.

Trigonium tabellarium (Bright.) Mann.

Triceratium tabellarium Bright. Quart. Journ. Micr. Sci. **4:** 275. *pl. 17. f. 15.* 1856. Moeb. Diat.-taf. *pl. 9. f. 15.* 1890. Schmidt, Atlas *pl. 77. f. 1–2* (*f.* 3–5 according to Grun.). 1882. Jan. Diat. Gaz. Exped. *pl. 9. f. 7.* De Toni, Syll. Alg. **2:** 953. 1894. Pritch. Hist. Infus. ed. 4. 854. Cleve, Bih. Sv. Vet. Akad. Handl. **5**^{8}: 17. *pl. 5. f. 31.* 1878.

Triceratium johnsoni Ralfs in Pritch. Hist. Infus. ed. 4. 854. 1861 ?.

Triceratium venulosum Grev. Trans. Micr. Soc. Lond. n. s. **12:** 90. *pl. 13. f. 21.* 1864. Moeb. Diat.-taf. *pl. 61. f. 21.* 1890. Schmidt, Atlas *pl. 77. f. 6–9.* 1882; *pl. 127. f. 3.* 1888 (not Gr. & St. Journ. Quek. Micr. Club II. **2:** 327. *pl. 19. f. 15–16.* 1886).

Triceratium pallidum Grev. Trans. Micr. Soc. Lond. n. s. **12:** 84. *pl. 11. f. 7.* 1864. Moeb. Diat.-taf. *pl. 59. f. 7.* 1890. De Toni, Syll. Alg. **2:** 938. 1894.

Triceratium brevinervum Grev. Trans. Micr. Soc. Lond. n. s. **13:** 101. *pl. 9. f. 26.* 1865. Moeb. Diat.-taf. *pl. 69. f. 26.* 1890.

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[a] Cf. Ber. Akad. Wiss. Berl. **1844:** 38. 1845; Mikrog. *pl. 18. f.* 50, *pl. 33. XVI. f. 13.* 1854.

[b] Trans. Micr. Soc. Lond. n. s. **9:** 72. *pl. 8. f. 16.* 1861.

[c] Trans. Micr. Soc. Lond. **2:** 74. 1854.

[d] Van Heur. Synop. *pl. 99. f. 1–3.* 1881.

[e] Quart. Journ. Micr. Sci. **1:** 251. *pl. 4. f. 15.* 1853, and cf. with Brightwell's figure of this species on the same plate.

Triceratium grave Schmidt, Atlas *pl. 77. f. 17.* 1882. Truan & Witt, Diat. Hayti 22. *pl. 7. f. 1, 13.* 1888. De Toni, Syll. Alg. **2**: 946. 1894.

Biddulphia tabellarium Boyer, Proc. Acad. Phila. **1900**: 718. 1901.

The form described and figured (with some doubt) as this species by Grove and Sturt is another species, as Schmidt makes it,[a] calling it *T. majus* Gr. & St. It is clearly a Biddulphia, having strongly developed processes at the angles. *T. venulosum* Grev. is simply a delicate variety of *T. tabellarium.*

Found at stations 2807, 3604, Galapagos Islands and Bering Sea.

Trigonium trinitas (Brun) Mann.

Triceratium trinitas Brun; Schmidt, Atlas *pl. 166. f. 3–4.* 1891.

The general build of this species is that of a very minute *T. arcticum;* but the beading is very different, coarse, each bead having a central dot, showing no trace of radial arrangement. The beads are similar to those of *T. luminosum* Brun & Temp., especially as figured by Schmidt.[b] But unlike the latter, they have no processes at the angles (seen best in the original figure).[c] The border is unusually massive and transversely striated. My specimen agrees best with the variety called *minima* (fig. 4 above).

Found at station 3603, Bering Sea.

Trigonium zonulatum (Grev.) Mann.

Triceratium zonulatum Grev. Trans. Micr. Soc. Lond. n. s. **13**: 102. *pl. 9. f. 17.* 1865. Moeb. Diat.-taf. *pl. 69. f. 17.* 1890. Schmidt, Atlas *pl. 77. f. 33–37.* 1882; *pl. 94. f. 9.* 1886.

Amphitetras zonulata De Toni, Syll. Alg. **2**: 900. 1894.

Biddulphia parvula Boyer, Proc. Acad. Phila. **1900**: 725. 1901, in part.

This diminutive and fine diatom is exceedingly abundant in the single hydrographic sounding below. It entirely lacks the characteristic Biddulphia (or "Amphiteras") processes at the angles. I therefore think it is inadmissible to class it as Boyer or De Toni does. It is not exactly the same as the *Amphitetras parvula* Jan. & Rabh.[d] and it is a question if that name could stand, having been published the same year, 1863, as *A. parvula* Grev., a totally different diatom. De Toni, Cleve, and others class *T. zonulatum* and *A. parvula* separately.

My specimens are remarkably uniform in size, all measuring about 0.02 mm.

Found at station 4029H, Bering Sea.

DITYLUM Bail.

Ditylum Bail. Bost. Journ. Nat. Hist. **7**: 332. *pl. 6. 10–15.* 1861. Van Heur. Synop. 196. 1885. De Toni, Syll. Alg. **2**: 1017. 1894. Boyer, Proc. Acad. Phila. **1900**: 730–731. 1901.

Triceratium Ehrenb. in part; West, Trans. Micr. Soc. Lond. n. s. **8**: 149. *pl. 8. f. 1, 5, 8.* 1860. Van Heur. Synop. *pl. 114. f. 3–9.* 1881.

The members of this genus have not the remotest likeness to forms of Triceratium Ehrenb., except in the imperfect triangular outline of the valves, and this is inconstant. Their pellucid, sparingly silicified frustules; their long and massive central spines; the peculiar topography of the valves, with a flat central area surrounded by portions sloping downward at a considerable angle, and the great breadth of the girdles separating the valves make them clearly deserving of a separate generic rank. A reference is made by L. W. Bailey to these forms having been recorded by his father under the generic name Grymaia, which has never been published except as a synomym. Van Heurck spells this genus Ditylum in his text, but Ditylium in his plates. De Toni spells it Ditylium and says in a note—"Nonnulli auctores scribunt Ditylum, ex. gr. clarus Van Heurck." I prefer to retain the original spelling as above.

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[a] Schmidt, Atlas *pl. 127. f. 1.*

[b] Schmidt, Atlas *pl. 159. f. 8.* 1890.

[c] Mem. Soc. Phys. Hist. Nat. Geneva **30**^{9}: *pl. 6. f. 3.* 1889.

[d] Rabh. Beitr. **1**: 4. *pl. 1. f. 4.* 1863.

Ditylum sol (Van Heur.) De Toni, Syll. Alg. **2**: 1018. 1894.
Triceratium (*Ditylium*) *sol* Van Heur. Synop. *pl. 115. f. 1–2.* 1881. Schmidt, Atlas *pl. 152. f. 4–9.* 1890.

There is a close similarity in all the forms of Ditylum that gives ground for the suspicion that they may eventually be found to be varieties of one species.

Found at station 4505H, Santa Cruz Light-House, Monterey Bay, Cal.

Ditylum undulatum (Bright.) Mann.
Triceratium undulatum Bright. Quart. Journ. Micr. Sci. **6**: 154. *pl. 8. f. 1–5, 8.* 1858. Cleve, Bih. Sv. Vet. Akad. Handl. **1**^{11}: 6. 1873. Cleve, Bih. Sv. Vet. Akad. Handl. **5**^{8}: 17. 1878.
Triceratium undulatum Ehrenb.; Schmidt, Atlas *pl. 151. f. 41.* 1890. Pant. Beitr. Bacill. Ung. **1**: *pl. 18. f. 164.* 1886.
Triceratium undulatum W. Smith; Lewis, Proc. Acad. Phila. **1861**: 65. 1862.
Triceratium (*Ditylium*) *ehrenbergii* Grun.; Van Heur. Synop. *pl. 115. f. 7–8.* 1881. Walk. & Chase, Notes on Diat. **2**: 5. *pl. 4. f. 12.* 1887.
Triceratium intricatum West, Trans. Micr. Soc. Lond. n. s. **8**: 149. *pl. 7. f. 5a–b.* 1860. Van Heur. Synop. *pl. 114. f. 2.* 1881.
Ditylum intricatum Grun.; Van Heur. Synop. 196. 1885.
Triceratium brightwellii West, Trans. Micr. Soc. Lond. n. s. **8**: 149 (*pl. 7. f. 6.* doubtful). 1860. Van Heur. Synop. *pl. 114. f. 3–9.* 1881.
Ditylum trigonum Bail. Bost. Journ. Nat. Hist. **7**: 332. *pl. 7. f. 6, 10, 11.* 1861. H. L. Smith, Sp. Diat. Typ. no. 142. 1874.
Ditylum inaequale Bail. Bost. Journ. Nat. Hist. **7**: 332. *pl. 7. f. 12–14.* 1861.

Tuffen West in his discussion of Brightwell's forms confuses matters considerably. He divides the latter's *T. undulatum* into two species, *T. intricatum* and *T. brightwellii*. He speaks of the form he calls *T. brightwellii* as having inflated margins and refers to Brightwell's figure, which shows that characteristic; yet in his own figure 6a he fails to show that margin. Or, if by "margin" he means outline, the convexity he shows in his figure is lacking in the figure he mentions in Brightwell's plate. I take it that both of West's forms are only varieties of Brightwell's species.

Ehrenberg's *Discoplea undulata* [a] probably does not belong here; but rather is allied to *Triceratium radiatum* Bright., a species distinct from this. It is also uncertain if his specimen from the so-called "Bermuda earth," referred to [b] as *Triceratium undulatum* is this species. It more probably is his *Discoplea undulata*. This Ralfs also looks upon as distinct from the present species. He says [c] that it is probably identical with *T. crenatum* Kitt. (MSS.), and that its nearly orbicular outline and crenate margin "distinguish it from *T. brightwellii*." On these grounds alone it could, however, hardly be so distinguished. There is no question that what Schmidt calls *T. undulatum* Ehrenb.[d] belongs here.

Found at station 4029H, Bering Sea.

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[a] Ehrenb. Mikrog. *pl. 33. XVIII. f. 3.* 1854.
[b] Ber. Akad. Wiss. Berl. **1844**: 273. 1845.
[c] Pritch. Hist. Infus. ed. 4. 939. 1861.
[d] Schmidt, Atlas *pl. 151. f. 41.* 1890.

BIDDULPHIA S. F. Gray.

Biddulphia S. F. Gray, Nat. Arr. **1**: 294. 1821. Van Heur. Synop. 203. 1885.

Odontella C. Ag. Consp. Crit. Diat. 56. 1832. Kütz. Bacill. 137. *pl. 18. f. VIII. 1–3, 6–8.* 1844.

Zygoceros Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1839**: 131, 160. *pl. 4. f. 11–12.* 1841; Mikrog. *pl. 35. A. XXIII. f. 17.* 1854. Bail. Am. Journ. Sci. **46**: 138. 1844.

Amphitetras Ehrenb. in part; Phys. Abh. Akad. Wiss. Berl. **1839**: 122, 142. 1841. Kütz. Bacill. 135. *pl. 19. f. 3.* 1844.

Cerataulus Ehrenb. in part; Ralfs in Pritch. Hist. Infus. ed. 4. 847. 1861. Cleve, Journ. Quek. Micr. Club II. **2**: 171. 1885. Pant. Beitr. Bacill. Ung. **2**: 97. 1889; **3**: *pl. 29. f. 421.* 1893.

Triceratium Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1839**: 129, 159. *pl. 4. f. 10.* 1841, in part. Roper, Quart. Journ. Micr. Sci. **2**: 283. *f. 1.* 1854. Bright. **4**: 274. *pl. 17. f. 9–12.* 1856.

Denticella Ehrenb.; Ehrenb. in Ber. Akad. Wiss. Berl. **1840**: 207. 1841. Grun. Denkschr. Akad. Wien $\mathbf{48^2}$: 59. 1884.

Odontotropis Grun.; in part, De Toni, Syll. Alg. **2**: 881. 1894.

In including the above genera, wholly or in part, in Biddulphia a generic unity is attained that is most desirable. This fact has long been appreciated by most diatomists, and the synonymy here enumerated is essentially that of Grunow, Van Heurck, Brun, Witt, Boyer, etc. A careful study of these forms convinces me that the plan adopted in De Toni's Sylloge Algarum of reestablishing Odontella, Zygoceros, Denticella, and Cerataulus as independent genera is unwise. No set of distinguishing characteristics important and constant enough to serve as generic definitions can be found for these names. Although this will become sufficiently evident in considering the separate species following, an illustration or two may be here mentioned. For example, a comparison of *Odontella obtusa* Kütz.,[a] with *Biddulphia roperiana* Grev.,[b] and of these two with *Cerataulus galapagensis* Schmidt,[c] will make it clear how futile it is to attempt to make generic distinctions between these three diatoms. The genus Zygoceros is deservedly obsolete; compare *Z. radiatus* Bail.[d] with *Biddulphia balaena* (Ehrenb.) Bright.[e] Amphitetras might be blended with that unscientific complex "Triceratium," a genus made up chiefly of evident forms of Biddulphia, but in its general structure, in the markings and processes of the valves, and in the zigzag, chain-like growth of its members it is so typical a Biddulphia that the example of Van Heurck, Boyer, and others, in classing most of its species as Biddulphia certainly deserves imitation. The genus Triceratium is chiefly made up of biddulphoid forms, which are here classed in this genus. A full discussion of the relationship between Biddulphia and Triceratium will be given under the genus Trigonium. See also remarks under the genera Aulacodiscus and Porpeia.

Biddulphia alaskiensis Mann, sp. nov. PLATE XLVI, FIGURE 1.

Valve broadly oval, nearly circular, evenly and strongly convex, the two processes barely elevated above the surface of the valve; markings of minute and purely radial beading, there being, however, a slight curvature of the lines toward the sides of the two processes; a few minute spines scattered irregularly over the surface of the beading; a single large horn, placed near the margin, one-fourth the distance between one process and the other and pointing radially outward; border narrow and hyaline.

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[a] Kütz. Bacill. *pl. 18. VIII. f. 1–3.* 1844; or Van Heur. Synop. *pl. 100. f. 11–14.* 1881.

[b] Van Heur. Synop. *pl. 99. f. 4–6.* 1881. Trans. Micr. Soc. Lond. n. s. **7**: *pl. 8. f. 11–13.* 1859.

[c] Schmidt, Atlas *pl. 115. f. 8.* 1888.

[d] Smithson. Contr. Knowl. **7**: *pl. 1. f. 29.* 1854.

[e] Quart. Journ. Micr. Sci. **7**: *pl. 9. f. 15.* 1859; or Van Heur. Synop. *pl. 112. f. 1.* 1887.

Length of valve, 0.063 mm.; width of valve, 0.053 mm.

Type in the U. S. National Museum, No. 590135, from station 3399H, Bering Sea, August 20, 1893; 12,041 fathoms, bottom of green mud and sand.

This minute species is essentially the same as that figured by Schmidt and marked "n. s. ?." It is if anything more nearly circular than Schmidt's figure. It has a slight resemblance to *B. edwardsii* Feb. in some of its broad varieties. I find it, however, impossible to assign it to that species.

Biddulphia antediluviana (Ehrenb.) Van Heur. Synop. 207. 1885.

Amphitetras antediluviana Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1839**: 142. 1841. Kütz. Bacill. 135. *pl. 19. f. 3, pl. 29. f. 86.* 1844. Rabh. Fl. Eur. Alg. **1**: 318. *f. 86.* 1864. Pritch. Hist. Infus. ed. 4. 858. *pl. 11. f. 21–22.* 1861. Ehrenb. Mikrog. *pl. 19. f. 19, pl. 21. f. 25a–c.* 1854. W. Smith, Synop. Brit. Diat. **2**: 47. *pl. 44. f. 318, pl. 44. f. 318a.* 1856. Eng. & Pr. Pflanzenfam. **1**^{1b}: 41. *f. 53D.* 1896. De Toni, Syll. Alg. **2**: 899. 1894. Schmidt, Atlas *pl. 99. f. 1–4, 6–9.* 1886.

Triceratium antediluvianum Grun. in Fenzl, Reise Novara Bot. **1**: 24. 1870. Van Heur. Synop. *pl. 109. f. 4–5.* 1881. Eng. & Pr. Pflanzenfam. **1**^{16}: 50. *f. 60.* 1896.

Biddulphia vesiculosa Boyer, Proc. Acad. Phila. **1900**: 716. 1901. ?

Although this diatom is plainly a Biddulphia, it has been so long and widely referred to as *Amphitetras antediluviana* that many authors are reluctant to drop the untenable generic name. Van Heurck in his plates carries out Grunow's suggestion of making it a Triceratium; but in the text of his Synopsis, published four years later, the above name is assigned.[a] This is certainly its proper place, rather than with Triceratium; for if that genus is to be weeded out and under the name Trigonium to be so reconstructed as to scientifically denote a class of forms not at present assignable elsewhere it must be freed from such manifest Biddulphia forms as this. As there is room for some doubt, expressed by De Toni and others, of this species being identical with Agardh's *Diatoma vesiculosum*[b] or *Isthmia vesiculosa*,[c] I do not here adopt the specific name assigned by Boyer above, but follow the opinion of Van Heurck, who in this respect agrees with Ehrenberg, Kützing, Ralfs, and Grunow.

Some of the figures of this diatom, notably those by Kützing, Pritchard, and Wolle, (those of the last copied from Van Heurck),[d] are so unlike this form as to be utterly misleading.

Found at stations 2680H, 2807, 2835, off central California to Galapagos Islands.

Biddulphia aurita (Lyng.) Breb. & God. Consid. Diat. 12. 1838. W. Smith, Synop. Brit. Diat. **1**: 49. *pl. 45. f. 319.* 1853. Jan. Abh. Schles. Ges. Vaterl. Cult. **1862**^{2}: 16. *pl. 1A. f. 9.* 1862. Rabh. Fl. Eur. Alg. **1**: 311. 1864. O'Meara, Proc. Roy. Irish Acad. II. **2**: 274. *pl. 27. f. 8.* 1875. Griff. & Henf. Micr. Dict. ed. 3. *pl. 19. f. 9.* 1875. Schmidt, Atlas *pl. 122. f. 6.* 1888. Van Heur. Synop. 205. *pl. 98. f. 4–12.* 1881–5. Wolle, Diat. N. A. *pl. 96. f. 9–11.* 1890.

Diatoma auritum Lyng. Hydro. Dan. 182. *pl. 62. f. D.* 1819.

Odontella aurita C. Ag. Consp. Diat. 56. 1830–32. Kütz. Bacill. 137. *pl. 29. f. 88.* 1844. De Toni, Syl. Alg. **2**: 862. 1894.

Denticella aurita Ehrenb. Mikrog. *pl. 35A. XXIII. f. 7.* 1854. Bail. Am. Journ. Sci. II. **22**: 1. *pl. 1. f. 26–28.* 1856.

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[a] Van Heur. Synop. 207. 1885.

[b] C. Ag. Syst. Alg. 7. 1824.

[c] C. Ag. Consp. Crit. Diat. 55. 1830–1832.

[d] Van Heur. Synop. *pl. 103. f. c.* 1881.

Denticella gracilis Ehrenb. Ber. Akad. Wiss. Berl. **1840:** 204. 1841.
Biddulphia sansibarica Schmidt, Atlas *pl. 122. f. 10–12.* 1888.
Denticella zanzibarica De Toni, Syll. Alg. **2:** 886. 1894.

This well-known and variable species is met with in large quantities at some of the stations, especially at stations 2844 and 3361H. At station 3569H it is present, but very rare. A minute and strongly divergent variety occurs at station 4029H, which is the same as that figured in Schmidt's Atlas, plate 122, figures 10 to 12, and named *B. sansibarica* Schmidt. There can be no reasonable doubt of this being *B. aurita* if a careful examination is made of its many varieties, or even if, taking Schmidt's own figures, we compare figure 2 and figure 7 with figure 12, and also figure 8 with figures 10 and 11 in plate 122. De Toni not only accepts them as specifically distinct, but assigns them to separate genera. (See the citations above.)

Found at stations 2287H, 2690H, 2844, 2848, 2859, 2882, 2920H, 3361H, 3569H, 3635H, 3671H, 3688H, 3691H, 3692H, 3694H, 3704H, 3912H, 4013H, 4014H, 4029H, off central California to Bering Sea and south to Honshu and Hawaiian islands.

Biddulphia biquadrata (Jan.) Boyer, Proc. Acad. Phila. **1900:** 717. 1901.
Triceratium biquadratum Jan.; Schmidt, Atlas *pl. 98. f. 4–6, pl. 99. f. 25–26.* 1886. Jan. Gaz. Exped. *pl. 11. f. 1, 4–6.*

I include figures 25 and 26 in Schmidt's Atlas, plate 99, as they are certainly the same species as that figured in plate 98. Both come from the Gazelle Expedition. *Triceratium junctum* Schmidt[a] is very close to the above.

Found at station 2807, Galapagos Islands.

Biddulphia consimilis (Grun.) Boyer, Proc. Acad. Phila. **1900:** 709. 1901.
Triceratium consimile Grun.; Van Heur. Synop. *pl. 108. f. 2.* 1881. Schmidt, Atlas *pl. 84. f. 13–14.* 1885.

The above figures need to be taken together. Schmidt's representation of the general form is excellent, but his figure and description of the secondary markings are wrong. Grunow's own figure cited above shows that these are not a central nodule surrounded by a faint circle, but a central nodule and a row of bright bead-like puncta close to and parallel to the walls of the hexagons. The nodule and the puncta are in two planes of focus, so that when the nodule is distinct the row of puncta assumes the appearance of a ring. Hence Schmidt's mistake.

Found at station 2807, Galapagos Islands.

Biddulphia culcitella Mann, sp. nov. PLATE XLVI, FIGURE 3.

Valve rectangular, the four sides sharply concave; the four horns or processes narrow and slightly prolonged beyond the border line; markings of beading, evenly and finely distributed over the entire valve in rows radial from the center, where six or eight beads are loosely grouped to form an indistinct rosette; valve surface very slightly convex until close to the margin, where it curves rapidly downward to the ribbed border; all specimens are marked with two sets of strong hyaline ridges, one forming a circle about the center with a diameter of one-half that of the valve, the other set consisting of two parallel ridges proceeding backward from the base of each of the four processes for a short distance, about one-eighth the diameter of the valve, where they separate at right angles and end at the margin.

Diameter of valve (between two apices), 0.081 mm.

Type in the U. S. National Museum, No. 590136 from station 2807, Galapagos Islands, April 4, 1888; 812 fathoms, bottom of Globigerina ooze and coral mud.

This form is of the "Amphitetras" type, and would be classed by some authors in that genus (here united with Biddulphia) and by others in Triceratium, from which these Biddulphia forms are here removed.

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[a] Schmidt, Atlas *pl. 98. f. 1–3, 19.* 1886.

Biddulphia dubia (Bright.) Cleve, in Nordensk. Vega Exped. **3**: 508. 1883. Boyer, Proc. Acad. Phila. **1900**: 707. 1901.

Odontidium punctatum Roper ?, Quart. Journ. Micr. Sci. **7**: 180. *pl. 9. f. 9.* 1859. Moeb. Diat.-taf. *pl. 23. f. 9.* 1890.[a]

Triceratium bullosum Witt, Journ. Mus. Godef. **1**: 67. *pl. 8. f. 4.* 1873.

Triceratium dubium Bright. Trans. Micr. Soc. Lond. n. s. **7**: 180. *pl. 9. f. 12.* 1859. Schmidt, Atlas *pl. 78. f. 26–30.* 1882.

Triceratium (or *Biddulphia*) *bicorne* Cleve, Bih. Sv. Vet. Akad. Handl. **5**^{8}: 17. *pl. 5. f. 30.* 1878.

Amphitetras bicornis De Toni, Syll. Alg. **2**: 902. 1894.

Though this species has sometimes a rather close resemblance to minute specimens of *B. reticulata* Roper, and this led me for a time to make it a variety of the latter, a careful examination of many specimens of both forms, abundantly supplied in some of the dredgings, shows them to be essentially distinct. *B. dubia* is always small, its reticulations irregular and of unequal size, their dividing walls thick and crinkled, the border massive, and the valve outline rhombic. In *B. reticulata*, on the other hand, a larger diatom, the reticulations are quite regular, generally hexagonal, with thin dividing walls showing "knots" at their points of juncture, the border is not so massive, and the valve outline is either elliptical or with convex sides approaching that figure. Both species have secondary dotted markings within the reticulations, but those of *B. reticulata* are smaller and more distinct. The general similarity of these two species has, I think, led to the naming of Schmidt's figures[b] "*B. reticulata* Roper, var.?" whereas they are certainly closer to *B. dubia*. The union of *Triceratium bicorne* Cleve, and *Triceratium bullosum* Witt, which is recognized by De Toni[c] and by Boyer,[d] is rather difficult to admit, in view of Witt's carefully drawn figure and his plain description. Yet the close similarity of Witt's form to *Triceratium dubium* Bright. is undeniable, as is also the specific identity of *T. dubium* and *T. bicorne*. In fact, we have here an illustration of how misty and indefinable our specific boundaries really are, and how subsequently discovered specimens may bridge over the wide gap that separates apparently quite unlike species. This same condition has been previously referred to under *Auliscus punctatus* and *A. pruinosus* Bail.

Found at station 2885, off Oregon.

Biddulphia edwardsii Febiger; H. L. Smith, Sp. Diat. Typ. no. 623. 1874. Boyer, Proc. Acad. Phila. **1900**: 701. 1901.

Odontella edwardsii Grun.; Van Heur. Synop. *pl. 100. f. 9–10.* 1881. Grun. Denkschr. Akad. Wien **48**^{2}: 57. *pl. 2. f. 20.* 1884. De Toni, Syll. Alg. **2**: 865. 1894.

Biddulphia obtusa Ralfs, err. det. in Van Heur. Synop. *pl. 100. f. 11–14.* 1881.

Biddulphia polycanthos Brun. Mem. Soc. Phys. et Hist. Nat. Geneva **31**^{1}: 12. *pl. 12. f. 8a–b.* 1891.

Odontella ? *polycanthos* De Toni, Syll. Alg. **2**: 865. 1894.

I find two well-marked varieties of the above polymorphic diatom. One corresponds closely to what Brun (loc. cit.) has called *B. polycanthos*, and that, too, in the forms both with and without the large spines. Brun therefore erroneously makes these spines a mark of specific distinction for his form. Nor can the difference of *B. edwardsii*, having diagonal and *B. polycanthos* vertical lines of beading on the girdle, be admitted. For in most gatherings of *B. edwardsii*, where there is considerable diversity in size, both patterns of marking can be seen in abundance. Such, for example, is the case in the H. L. Smith type-slide no. 623 in possession of the U. S. National Museum. This species of Brun must, therefore, be ranked as a variety of the above. The second variety, found at station 2807, is the form called *Odontella obtusa* (Kütz.) Ralfs.[a] It is clearly a small variety of this species, exact examples being easily found in most large gatherings, as in the above-mentioned type-slide of H. L. Smith. But it is doubtful if this is the genuine *Odontella obtusa* Kütz., which seems to have a much closer resemblance to *B. roperiana* Grev.[b] Thus Kützing[c] figures it as a smoother diatom than *B. edwardsii*, as does also Ralfs,[d] and under its synonymous name of *O. biddulphioides* Wigand[e] it also differs greatly. I therefore have not included this in the above synonymy. *B. primordialis* Brun[f] is also omitted as a synonym. The figures of the two species are often quite close. But typical specimens of *B. primordialis* are frequent in gatherings made at stations 2844 and 3263H and when these are compared with examples of *B. edwardsii* the difference is seen to be far too wide to admit of their union. It is perhaps a comparison of the figures of these two diatoms, rather than the specimens themselves, that has led Grove to unite them.[g] De Toni[h] notes the similarity of the two, but gives Brun's form separate rank. I can not agree with H. L. Smith[i] in considering this species as "a hirsute variety of *B. roperiana* Grev."

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[a] Cf. De Toni, Syll. Alg. **2**: 641. 1892.

[b] Schmidt, Atlas *pl. 78. f. 21–23.*

[c] De Toni, Syll. Alg. **2**: 973. 1894.

[d] Proc. Acad. Phila. **1900**: 707. 1901.

The specimens found by me were mostly large forms, ranging from 0.095 mm. in station 3604 (Bering Sea) to 0.14 mm. in station 2848, south of Alaska peninsula.

Found at stations 2287H, 2807, 2848, 3604, 3693H, 4013H, off Alaska peninsula, to Bering Sea and south to Honshu Island, Japan.

Biddulphia extensa Mann. sp. nov. PLATE XLVII, FIGURES 1, 2.

Valve an elongated and perfectly symmetrical ellipse, about four and one-half times as long as wide, elegantly beaded with fine, round, closely set beads, radiating from a small circular hyaline central area, the lines so arranged as to form concentric ellipses on either half of the valve, these extending from the circular central area to the bases of the long vertical horns arising near the apices of the valve; of the lines radiating from the center only the two coinciding with the median transverse axis straight, the others curving in conformity with the two ellipses; two stout, straight, and long spines set on opposite sides of the central area, half way between the valve's longitudinal and transverse axes, and spread upward and outward; in zonal view the valve showing the two horns to be long, tapering, and vertical, and broadened into a flat-topped apex, this a little higher than the much elevated central area; the base of the valve joined to the girdle by a curved line; approximate valves of adjoining frustules united by the tips of the horns and further connected by a pellucid film-like silicious membrane at the center, parting and narrowing toward the apices; the two central areas almost touching, and the four long spines arising from these interlocked, the two from each valve being on opposite sides of the other valve.

In the single dredging in which this species was found it is abundant; but I have not been able to find any certain remains of the connecting girdle.

Length of valve, 0.130 mm; width of valve, 0.028 mm.

Type in U. S. National Museum, No. 590137, from station 4505 H, Santa Cruz lighthouse, Monterey Bay, Cal.; 10 fathoms.

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[a] Van Heur. Synop. *pl. 100. f. 11–14*. 1881.

[b] Quart. Journ. Micr. Sci. **7**: *pl. 8. f. 11–13*. 1859.

[c] Kütz. Bacill. 137. *pl. 18.* VIII. *f. 1–3, 6–8*. 1844.

[d] Pritch. Hist. Infus. ed. 4. 848. *pl. 13. f. 30–32A*. 1861.

[e] Hedw. **2**: 45. *pl. 7. f. 21*. 1860.

[f] Mem. Soc. Phys. et Hist. Nat. Geneva **31**^{1}: 12. *pl. 13. f. 9, pl. 14. f. 9*. 1891.

[g] Schmidt, Atlas *pl. 172. f. 4.*

[h] De Toni, Syll. Alg. **2**: 864. 1894.

[i] Am. Journ. Micr. **4**: 101. 1879.

Biddulphia favus (Ehrenb.) Van Heur. Synop. 208. 1885. Boyer, Proc. Acad. Phila. **1900:** 706. 1901.

Triceratium favus Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1839:** 159. *pl. 4. f. 10.* 1841; Mikrog. *pl. 19. f. 17.* 1854; Phys. Abh. Akad. Wiss. Berl. **1841:** 323, 443. *pl. 3. VII. f. 10.* 1843. Kütz. Bacill. 139. *pl. 18. f. 11.* 1844. W. Smith, Synop. Brit. Diat. **1:** 26. *pl. 5. f. 44, pl. 30. f. 44.* 1853. Pritch. Hist. Infus. ed. 4. 855. *pl. 11. f. 43-44.* 1861. Schmidt, Atlas *pl. 82. f. 1, 3, 4.* 1885. Jan. Abh. Schles. Ges. Vaterl. Cult. **1862**^{2}: 15. *pl. 1B. f. 9.* 1862. Wolle, Diat. N. A. *pl. 99. f. 1, 2.* 1890. Van Heur. Synop. *pl. 107. f. 1-4.* 1881. H. L. Smith, Sp. Diat. Typ. no. 598. 1874. O'Meara, Proc. Roy. Irish Acad. II. **2:** 277. 1875. Rabh. Fl. Eur. Alg. **1:** 315. *f. 87.* 1864. Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1839:** 159. *pl. 4. f. 10a-b.* 1841. Griff. & Henf. Micr. Dict. ed. 3. *pl.* 13. *f. 29.* 1875. Grun. in Fenzl, Reise Novara Bot. **1:** 24. 1870. Grun. Schmidt, Atlas *pl. 126. f. 5-7.* 1888. Carp. Micro. ed. 8. 613. *f. 442.* 1901. Leud.-Fort. Mem. Soc. Emul. St. Brieuc 60. 1879. Kain, Bull. Torr. Club **14:** 29. 1887. Truan & Witt, Diat. Hayti 21. *pl. 6. f. 8, pl. 7. f. 8.* 1888. Moeb. Diat.-taf. *pl. 1. f. 6.* 1890. Named varieties: Schmidt, Atlas *pl. 82. f. 2, 11, pl. 84. f. 4.* 1885; *pl. 93. f. 4.* 1886. Bright. Quart. Journ. Micr. Sci. **4:** 274. *pl. 17. f. 7.* 1856. Moeb. Diat.-taf. *pl. 9. f. 7.* H. L. Smith, Sp. Diat. Typ. no. 599. 1874. Grun.; Van Heur. Synop. *pl. 107. f. 5.* 1881. Kütz. Sp. Alg. 140. 1849. Castr. Rep. Voy. Chall. Bot. **2:** 109. *pl. 6. f. 1, pl. 9. f. 3.* 1886. Kitt. Mo. Micr. Journ. **12:** 219. *pl. 82. f. 7-8.* 1874.

Triceratium comptum Ehrenb. Ber. Akad. Wiss. Berl. **1843:** 166. 1844. Bright. Quart. Journ. Micr. Sci. **1:** 249. *pl. 4. f. 4.* 1853. Pritch. Hist. Infus. ed. 4. 857. 1861.

Triceratium megastomum Bright. err. det. Quart. Journ. Micr. Sci. **1:** 248. *pl. 4. f. 7.* 1853. Moeb. Diat.-taf. *pl. 1. f. 7.* 1890 (not Ehrenb. Mikrog. *pl. 35A XVII. f. 14.* 1854. nor Pritch. Hist. Infus. ed. 4. 855. 1861).

Triceratium muricatum Bright. Quart. Journ. Micr. Sci. **1:** 249. *pl. 4. f. 5.* 1853. Moeb. Diat.-taf. *pl. 1. f. 5.* 1890. Pritch. Hist. Infus. ed. 4. 856. 1861. Schmidt, Atlas *pl. 83. f. 8-10.* 1885. De Toni, Syll. Alg. **2:** 923. 1894.

Triceratium scitulum Bright. Quart. Journ. Micr. Sci. **1:** 250. *pl. 4. f. 9.* 1853. Moeb. Diat.-taf. *pl. 1. f. 9.* 1890. Schmidt, Atlas *pl. 83. f. 11-16.* 1885. Grun. in Fenzl, Reise Novara Bot. **1:** 24. 1870. De Toni, Syll. Alg. **2:** 922. 1894. Pritch. Hist. Infus. ed. 4. 857. 1861.

Triceratium grande Bright. Quart. Journ. Micr. Sci. **1:** 249. *pl. 4. f. 8.* 1853. Moeb. Diat.-taf. *pl. 1. f. 8.* 1890. Schmidt, Atlas *pl. 82. f. 5.* 1885. De Toni, Notar. **3:** 626. 1888. Pant. Beitr. Bacill. Ung. **1:** 54. *pl. 4. f. 33.* 1886. Pritch. Hist. Infus. ed. 4. 856. 1861. Truan & Witt, Diat. Hayti 21. *pl. 6. f. 10, pl. 7. f. 7.* 1888. Wolle, Diat. N. A. *pl. 104. f. 1.* 1890.

Triceratium fimbriatum Wallich, Quart. Journ. Micr. Sci. **6:** 247. *pl. 12. f. 4-9.* 1858. Schmidt, Atlas *pl. 82. f. 6-7.* 1885.

Biddulphia grandis Boyer, Proc. Acad. Phila. **1900:** 706. 1901.

The necessity of classing this as a Biddulphia becomes evident as soon as we disregard the unimportant fact that it is often found in triangular form. So far as my experience goes, it is quite as abundant in sea dredgings in the quadrate form. It is the dominant species of stations 2915H to 2921H, 3008H, 3010H, 3013H, 4430H, 4502H, and 4571H, where it occurs in immense quantities and without any of the triangular varieties present. H. L. Smith's type 599 is a similar case. He marks it "Tuscarora soundings S. of Sandwich Isl. 1468 fms.," the locality, therefore, corresponding almost exactly with station 3008H. Five to 8-angled forms are frequent in all large gatherings. But whether of triangular form or not, this species, seen from the valval side, but especially from the zonal side, with its horn-like processes at the angles and its peculiar set of the valves on the girdle, is shown to be an almost typical example of Biddulphia. Like all the other members of this genus, it is either marine or fossil.

I am at present unable to include in this species some forms so classed by other writers. Thus *Triceratium orientale* Bail. & Harv.[a] is hardly close enough to *T. grande* Bright., which it most resembles, to make me certain that it can be rightly identified with that form. It is, however, so disposed of by Habirshaw,[b] and is classed by him as a synonym of *Biddulphia grandis* (Bright.) Boyer, which is in this paper united with *B. favus*. The same is true of *Triceratium cuspidatum* Jan., which Boyer unites with this species, and De Toni is disposed to class with his emended genus Amphitetras. It is figured by Schmidt and also by Janisch.[c] A question might also be raised as to the rather divergent varieties above united with this species, viz, *Triceratium muricatum* Bright. and *T. scitulum* Bright. But Schmidt says,[d] "Ob *T. muricatum* und *scitulum* mehr sind als kleine Formen von *T. favus* ist noch genauer zu untersuchen," and Ralfs[e] says of *T. scitulum*, "Except in its smaller size, we see not how this species differs from *T. favus*." The *T. scitulum* variety is abundant at station 3604, which also contains fine examples of sexangular and octangular specimens of *T. grande*.

Found at stations 2807, 2808, 2915H, 2916H, 2917H, 2918H, 2919H, 2920H, 2921H, 3008H, 3010H, 3013H, 3604, 4430H, 4571H, Galapagos Islands to Bering Sea and Hawaiian Islands.

Biddulphia gladiorum Mann, sp. nov. PLATE XLVII, FIGURE 4.

Valve elongated-oval, flat to nearly the full outline of the frustule, then bending perpendicularly downward in a broad band to the line of suture with the girdle; top and vertical sides of the valve delicately beaded with Pleurosigma-like markings; the two terminal processes, corresponding to horns in similar species, here scarcely raised above the surface of the valve, appearing as small obliquely inclined rings; five stout setae, tapering to an acute point, and occasionally imperfectly forked, set close to the margin of the flat portion of the valve, their bases broadened and extending into a low delicate hyaline comb or ridge, thus forming a connecting line between the setae; a thread-like hollow central line within the setae extending to near the tip; two of the setae next to and interior to the two processes.

Length of valve, 0.11 mm.; length of setae, 0.043 to 0.06 mm.

Type in the U. S. National Museum No. 590138, from station 4029H, Bering Sea, June 27, 1900; 813 fathoms, bottom of gray sand and clay.

This diatom finds its nearest likeness in *Biddulphia spinosa* Grev.[f], though as to the flat top of the valve when seen in zonal view, as well as the delicate Pleurosigma-like markings, it resembles *B. cornuta* Brun.[g] Its distinctness from Brun's species is due to the absence of the long-produced horns with inflated bases, to its almost perpendicular sides from the girdle to the level valve face, and to the less significant difference in the shape and number of the spines. It belongs to that group of the Biddulphiae which De Toni[h] places in the genus Denticella, in conformity with Grunow's suggestion.[i] This grouping, which I do not consider to have any generic value, would bring together many similar forms of which *Biddulphia mobiliensis* (Bail.) Grun., may be taken as the type; diatoms of relatively large size but of exceedingly delicate silica walls, having two more or less produced horns at the extremities of the oval or elliptical valves, and further ornamented with from two to many long vertical and generally acuminate setae or spines.

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[a] Proc. Acad. Phila. **6**: 430. 1854. Wilkes Explor. Exped. **17**: 179. *pl. 9. f. 9.* 1862.

[b] Hab. Cat. 337.

[c] Schmidt, Atlas *pl. 84. f. 2-3.* 1885. Jan. Gaz. Exped. *pl. 11. f. 14-15.*

[d] Op. cit. *pl. 83. f. 11-16.*

[e] Pritch. Hist. Infus. ed. 4. 857. 1861.

[f] Trans. Micr. Soc. Lond. n. s. **13**: 6. *pl. 1. f. 3.* 1865. Moeb. Diat.-taf. *pl. 62. f. 3.* 1890.

[g] Le Diatomiste **2**: 74. *pl. 6. f. 3.* 1894.

[h] De Toni, Syll. Alg. **2**: 882-886. 1894.

[i] Denkschr. Akad. Wien **48**^{2}: 58. 1884.

Biddulphia granulata Roper, Trans. Micr. Soc. Lond. n. s. 7: 13. *pl. 1. f. 10–11*, *pl. 2. f. 12*. 1859. Moeb. Diat.-taf. *pl.* 25. *f. 10–11*, *pl. 26. f. 12*. 1890. Schmidt, Atlas *pl. 122. f. 18*. 1888. Van. Heur. Synop. *pl. 99. f. 7–8; pl. 101. f. 4*. 1881. Boyer, Proc. Acad. Phila. **1900**: 702. 1901.

De Toni [a] places this as a synonym under *Denticella turgida* Ehrenb. The unfigured description of that species by Ehrenberg [b] can not afford any satisfactory grounds for uniting these two.

Found at stations 3513, 3603, Bering Sea.

Biddulphia grundleri Schmidt, Atlas *pl. 118. f. 22–24*. 1888.

Although this might easily be considered a variety of *B. pulchella* Gray, I find sufficient contrast to warrant the acceptance of Schmidt's name, at least for the present. Not only the scarcely observable marking of the rounded ends of the horns mentioned by him in the above citation, but the large, widely set, and prominent beads which mark the valves of my specimens, instead of the more thickly set beading or reticulated marking of *B. pulchella*, present too strong a contrast to favor their union.

Found at station 4013H, east coast of Honshu Island, Japan.

Biddulphia keeleyi Boyer, Proc. Acad. Phila. **1898**: 469. *pl. 24. f. 4*. 1898; **1900**: 708. 1901.

Boyer gives three localities for this diatom, the last being Monterey Bay, California, and marks it "rare." In the single sounding where it appears, also made in Monterey Bay, it is abundant.

Found at station 4505H, near Santa Cruz light-house, Monterey Bay, Cal.

Biddulphia levis Ehrenb. Ber. Akad. Wiss. Berl. **1843**: 122. 1844. Boyer, Proc. Acad. Phila. **1900**: 712. 1901.

Odontella polymorpha Kütz. Bacill. 138. *pl. 29. f. 90*. 1844.

Cerataulus levis Ralfs in Pritch. Hist. Infus. ed. 4. 847. *pl. 6. f.* 7. 1861 (not *Biddulphia levis* (Ehrenb.) Ralfs in Pritch. Hist. Infus. ed. 4. 848. 1861, which is *Denticella levis* Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 204. 1845, and *Odontella levis* Kütz. Sp. Alg. 136. 1849). Schmidt, Atlas *pl. 116. f. 13–15*. 1886.

Cerataulus polymorphus Van Heur. Synop. *pl.* 104. *f.* 3–4. 1881.

This diatom, well deserving the specific name given by Kützing, *polymorpha*, was found in only one sounding. It was there unusually large and smooth.

Found at station 2920H, Hawaiian Islands.

Biddulphia luminosa (Brun & Temp.) Mann. PLATE XLVI, FIGURE 5.

Triceratium luminosum Brun & Temp. Mem. Soc. Phys. et Hist. Nat. Geneva 30^2: 62. *pl. 6. f. 3*. 1889. Schmidt, Atlas *pl. 159. f. 6*. 1890.

The authors distinguished this from the similar species, *T. africanum* Ehrenb.,[c] *T. gratum* Schmidt,[d] and *T. molleri* Pant.[e] It is, however, very close to the latter.

Two specimens were found by me, one with a length on side of 0.083 mm. and the other with a length on side of 0.153 mm. I figure this species because the drawings referred to above give in both instances emphasis to the dotted centers of the beads, an aspect entirely lacking in my specimens.

Found at stations 2694H, 4029H, off southern California and Bering Sea.

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[a] De Toni, Syll. Alg. **2**: 883. 1894.

[b] Ber. Akad. Wiss. Berl. **1840**: 207. 1841, or Pritch. Hist. Infus. ed. 4. 849. 1861.

[c] Ehrenb. Mikrog. *pl. 35A. XIXb. f. 1*. 1854.

[d] Schmidt, Atlas *pl. 77. f. 19*. 1882.

[e] Pant. Beitr. Bacill. Ung. **1**: 53. *pl. 6. f. 47*.

Biddulphia mobiliensis (Bail.) Grun.; Van Heur. Synop., *pl. 101. f. 4–6, pl. 103. f. A*. 1881. Schmidt, Atlas *pl. 122. f. 20–21.* 1888. Boyer, Proc. Acad. Phila. **1900**: 698. 1901.

Zygoceros (*Denticella?*) *mobiliensis* Bail. Smithson. Contr. Knowl. **2**^{8}: 40. *pl. 2. f. 34–35.* 1851. Pritch. Hist. Infus. ed. 4. 850. *pl. 6. f. 11.* 1861.

Biddulphia baileyi W. Smith, Synop. Brit. Diat. **2**: 50. *pl. 45. f. 322, pl. 62. f. 322.* 1856. Roper, Trans. Micr. Soc. Lond. n. s. **7**: 12. *pl. 1. f. 5–9.* 1859. O'Meara, Proc. Roy. Irish Acad. II. **2**: 275. *pl. 27. f. 8.* 1875. Rabh. Fl. Eur. Alg. **1**: 311. 1864.

Denticella mobiliensis Grun. Denkschr. Akad. Wien **48**^{2}: 7. 1884. De Toni, Syll. Alg. **2**: 882. 1894.

Found at stations 2923, 4505H, off southern California and near Santa Cruz Lighthouse, Monterey Bay, California.

Biddulphia ovalis (Schmidt) Boyer, Proc. Acad. Phila. **1900**: 712. 1901.

Cerataulus ovalis Schmidt, Atlas *pl. 115. f. 5–7.* 1888.

My form is drawn to a somewhat narrower oval and the processes are in the long axis. Found at station 2835, off Lower California.

Biddulphia pacifica (Grun.) Mann.

Cerataulus pacificus Grun.; Schmidt, Atlas *pl.* 115. *f. 10.* 1888.

Rattray [a] makes this a synonym of *Auliscus ralfsianus* Grev.[b] and *Eupodiscus barbadensis* Grev., [c] giving to it the name *Pseudoauliscus ralfsianus* (Grev.) Ratt. It may be well to look upon these as the same, in which case, the genus Pseudoauliscus not being admitted, the name here would be *A. ralfsianus* Grev. My specimen is, however, clearly a broad Biddulphia of the Cerataulus variety, and I prefer to agree with Grunow's analysis, but to include here, as in all other cases, the Cerataulus forms under Biddulphia.

Found at station 2807, Galapagos Islands.

Biddulphia papillata (Gr. & St.) Mann.

Triceratium papillatum Gr. & St. Journ. Quek. Micr. Club II. **3**: 76, *pl. 6. f. 14.* 1887. Schmidt, Atlas *pl. 128. f. 16.* 1888; *pl. 167. f. 5–6, pl. 168. f. 8.* 1891. De Toni, Syll. Alg. **2**: 962. 1894; Notarisia **2**: 351. 1887.

I found five specimens of this rare and striking diatom; one triangular and four of the quadrate variety. The smallest, a single valve, measured 0.048 mm. on each side; the largest, also a single valve, measured 0.137 mm. on each side; another, a complete frustule, measured 0.087 mm. on each side and between opposite horn tips on the zonal side it measured 0.138 mm. This last specimen showed all the curious markings figured by Grove, [a] except that the central brush-like clusters of setae were broken.

It is evident that Grove and Sturt in naming this species saw it in only one position, namely, the valval view, as they state that it is "very rare" and that they were indebted to Weissflog for their specimen. Their drawing is also the valval one. It is conceivable that, seen from this side only, it might be called Triceratium; but how Grove, having subsequently seen it from the zonal side, as is shown by his drawings,[d] could have failed to reclassify it as a Biddulphia it is difficult to understand. It is a perfectly typical example of this genus.

The complete frustrule figured by Grove came from the Hawaiian Islands, as did those figured by Schmidt. My specimens came from the same locality. But as the original specimen was found in a fossil deposit at Oamaru, New Zealand, it would be of geological interest to know how this rare and peculiar diatom came to be present in these two localities.

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[a] Journ. Roy. Micr. Soc. **8**^{2}: 43. 1888.

[b] Trans. Micr. Soc. Lond. n. s. **11**: 52. *pl. 3. f. 21.* 1863.

[c] Trans. Micr. Soc. Lond. n. s. **12**: 88. *pl. 12. f. 4.* 1864.

[d] Schmidt, Atlas *pl. 168. f. 8.* 1891.

Found at station 2920H, Hawaiian Islands.

Biddulphia primordialis Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **31**^{1}: 12. *pl. 13. f. 9, pl. 14. f. 9.* 1891. Schmidt, Atlas *pl.* 172. *f. 4.* (not *f. 5*). 1892.

Odontella primordialis De Toni, Syll. Alg. **2**: 864. 1894.

Grove has suggested [a] this being only a variety of *B. edwardsii* Febiger.[b] I have discussed the impossibility of looking on these two as the same species under the heading of *B. edwardsii* above.

I look upon figure 5 in the above citation from Schmidt's Atlas as an entirely distinct diatom.

Found at stations 2844, 3263H, off Alaska Peninsula and Aleutian Islands.

Biddulphia pulchella Gray, Nat. Arr. **1**: 294. 1821. Grev. Trans. Micr. Soc. Lond. n. s. **10**: 25. *pl. 3. f. 3-4.* 1862. W. Smith, Synop. Brit. Diat. **2**: 48. *pl. 44. f.* 321. 1856. Pritch. Hist. Infus. ed. 4. 848. *pl. 2. f. 56-60.* 1861. Schmidt, Atlas *pl. 118. f. 26-32, pl. 121. f. 1-2.* 1888. O'Meara, Proc. Roy. Irish Acad. II. **2**: 275. *pl. 27. f. 9.* 1875. Van Heur. Synop. 204. *pl. 97. f. 1-5.* 1881-1885. Rabh. Fl. Eur. Alg. **1**: 310. 1864. De Toni, Syll. Alg. **2**: 870. 1894. Eng. & Pr. Pflanzenfam. **1**^{1b}: 42 *f. 54 A-C.* 1896.

Conferva biddulphiana J. E. Smith, Eng. Bot. **25**: *pl.* 1762. 1807?

Diatoma biddulphianum C. Ag. Syst. Alg. 5. 1824?

Denticella biddulphia Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: *pl. 2. VI. f. 19.* 1842.

Biddulphia quinquelocularis Kütz. Bacill. 138. *pl. 19. f. 1.* 1844.

Biddulphia septemlocularis Kütz. Bacill. 138. *pl. 19. f. 2.* 1844.

Biddulphia trilocularis Kütz. Bacill. 138. *pl. 29. f. 89.* 1844.

Biddulphia transversa Wigand, Hedwigia **2**: 45. *pl. 7. f. 18.* 1860.

Biddulphia unifasciata Wigand, Hedwigia **2**: 45. *pl. 7. f. 19.* 1860

Biddulphia bifasciata Wigand, Hedwigia **2**: 45. *pl. 7. f. 20.* 1860.

Biddulphia biddulphiana Boyer, Proc. Acad. Phila. **1900**: 694. 1901.

The question of the substitution of the name *Biddulphia biddulphiana* (J. E. Smith) Boyer,[c] for the above depends on whether or not the figures given by Smith [d] are identical with this species. There should be no question of such identity before a name like this one, of long standing and adopted in nearly every diatom work extant, is discarded. In this case two facts should be borne in mind, first, that this species is similar to several other species generally recognized as worthy of separate rank which are equally like the figures of J. E. Smith. Such are *Biddulphia grundleri* Schmidt,[e] which is not united with this species by either De Toni or Boyer, and *Biddulphia tridens* Ehrenb.[f] The second fact is that the figures of J. E. Smith are not those of one species. I have, therefore, not followed Boyer in making the above specific name a synonym under that of J. E. Smith's.

This widely distributed species is remarkably infrequent in the Pacific dredgings examined by me. In none of the following gatherings was it at all abundant.

Found at stations 2807, 2808, 2920H, 3604, Galapagos Islands, Hawaiian Islands, and Bering Sea.

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[a] Schmidt, Atlas *pl. 172. f. 4.* 1892.

[b] Op. cit. *pl. 167. f. 5-6.*

[c] Proc. Acad. Phila. **1900**: 694. 1901.

[d] J. E. Smith, Eng. Bot. **25**: *pl. 1762.* 1807.

[e] Schmidt, Atlas *pl. 118. f. 22-24.* 1888.

[f] Ehrenb. Mikrog. *pl. 19. f. 21, pl. 20. I. f. 53.* 1854. (*Zygoceros tuomeyi* Bail. Am. Journ. Sci. **46**: 138. *pl. 3. f. 3, 4, 8.* 1844.)

Biddulphia reticulata Roper, Trans. Micr. Soc. Lond. n. s. **7**: 14. *pl. 2. f. 13-15.* 1859. Moeb. Diat.-taf. *pl. 26. f. 13-15.* 1890. Castr. Rep. Voy. Chall. Bot. **2**: 102. *pl. 26. f. 9.* 1886. Boyer, Proc. Acad. Phila. **1900**: 708. 1901. Van Heur. Synop. *pl. 102. f. 1-2* (not *f. 3*). 1881.

Odontella? reticulata DeToni, Syll. Alg. **2**: 868. 1894.

Typical examples of this diatom are plentiful in the dredging to be cited. For a discussion of the confusion between quadrate specimens of this species and *B. dubia* (Bright.) Cleve, see under that species.

Found at station 3696, off Honshu Island, Japan.

Biddulphia robertsiana (Grev.) Boyer, Proc. Acad. Phila. **1900**: 707. 1901.

Triceratium robertsianum Grev. Quart. Journ. Micr. Sci. n. s. **3**: 231. *pl. 9. f. 9.* 1863; **6**: *pl. 2. f. 2.* 1886. Moeb. Diat.-taf. *pl. 47. f. 9, pl. 71. f. 22.* 1890. Schmidt, Atlas *pl. 83. f. 3-7* (var.), *pl. 82. f. 14-15.* 1885.

This diatom is rather close to the *Triceratium grande* form of *Biddulphia favus* (Ehrenb.) Van Heurck, both in its general shape and in the fine radiating secondary markings. Still, the fact that the processes are very obtuse and separated by a hyaline area from the reticulation and that the angles are not at all prominent, together with the general presence of large spines on the sides, give it an aspect that warrants its separate name. It is quite possible that the first of the Greville figures cited above is of "*Triceratium grande*" and his second figure that of the true type. They are very dissimilar. The second is at any rate more like the forms classified by me in the present species and agrees better with the description given by Greville, except in the matter of spines, all my specimens having two stout spines near the margin of each of the three sides. It is spoken of by Greville, Schmidt, and Boyer as very rare. In the single gathering where I found it it is fairly abundant. Boyer says: "Pacific soundings 20° 10′ N., 158° 14′ W., 2,507 fathoms." My specimens came from Pacific soundings 21° 21′ N., 157° 09′ W., and though the depth is only 570 fathoms, the location is right on the edge of a deep plain averaging 2,500 fathoms; this particular sounding being just close enough inshore to get the rise of the land from the true sea bottom. This is another one of many instances described in this work where a single species is very significant of locality on the sea bottom.

Found at station 2920H, Hawaiian Islands.

Biddulphia roperiana Grev. Trans. Micr. Soc. Lond. n. s. **7**: 163. *pl. 8. f. 11-13.* 1859. Van Heur. Synop. *pl. 99. f. 4-6.* 1881. Schmidt, Atlas *pl. 120. f. 20-24.* 1888. H. L. Smith, Diat. Sp. Typ. no. 625. 1874. Boyer, Proc. Acad. Phila. **1900**: 700. 1901. Castr. Rep. Voy. Chall. Bot. **2**: 106. *pl. 26. f. 4.* 1886.

PLATE XLVI, FIGURE 2.

Odontella roperiana De Toni, Syll. Alg. **2**: 868. 1894.

It is also possible, as suggested by Boyer,[a] that *Biddulphia* (*Odontella*) *discigera* Grun. and *Triceratium* (*Odontella discigera* var.?) *californicum* Grun.[b] might be classed as synonymous with the above; but without more light than these two figures afford I am unwilling to agree to the suggestion. As has been stated under *Biddulphia edwardsii* Febiger, I find that *B. obtusa* (Kütz.) Ralfs, as figured in Van Heurck[c] agrees better with that species than with this one, though De Toni[d] favors the idea of this species being a large form of Kützing's species. As to that matter I have much doubt about there being any close similarity between these species independent of the relation of Van Heurck's figures. De Toni follows the reference to Van Heurck's figure with the remark, "*Odontella roperiana* (Grev.) videtur forma major hujus speciei," but he gives separate rank to Kützing's and Greville's species. Grunow[a] says, under *B. obtusa* (Kütz.) Grun.: "Hierher scheint mir als grosse Form *Bidd. roperiana* Grev. zu gehören." Grunow here incorrectly credits the inclusion of Kützing's species in Biddulphia to himself, an error repeated by Schmidt.[b] It was previously so classed by Ralfs.[c] I think it is on the whole best to do as Van Heurck and De Toni have done, notice the resemblance between Kützing's and Greville's species, but keep them separate. The same will be true of the synonym of Kützing's species, *Odontella biddulphioides* Wigand.[d] A new variety is here figured.

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[a] Proc. Acad. Phila. **1900**: 700. 1901.

[b] Van Heur. Synop. *pl. 108. f. 9, 11.* 1881.

[c] Op. cit. 100. *f. 11-14.* 1881.

[d] De Toni, Syll. Alg. **2**: 863. 1894.

Found at stations 3604, 3688H, 3712H, Bering and Okhotsk seas.

Biddulphia scutellum Mann sp. nov. PLATE XLVII, FIGURE 3.

Valve an elongated oval, the surface evenly convex except for a circular central area as wide as the valve, this flat (not concave); markings of the central area, fine beading in radiating rows from two approximate foci; of the rest of the valve, of similar beading in rows running chiefly parallel with the long axis of the valve; in addition to this beading, minute pointed processes scattered evenly over the entire valve, as in valves of *B. edwardsii* Febiger; the two processes, short, broad, and circular, close to the ends of the valve.

Length of valve, 0.152 mm.; width of valve, 0.058 mm.

Type in the U. S. National Museum, No. 590139, from station 2844, off Aleutian Islands, July 28, 1888; 54 fathoms, bottom of gray sand.

The nearest species to this one is *Biddulphia obtusa* (Kütz.) Ralfs, in the doubtful figure of it given in Van Heurck,[e] which, as before stated, is somewhat nearer to *B. edwardsii* Febiger. This fact, taken in connection with the presence of fine spines scattered over my specimens similar to those on *B. edwardsii*, makes it possible that both this species and the forms figured in Van Heurck are extreme varieties of Febiger's species. On the other hand, both may be representatives of a separate species. My specimen differs from that figured by Van Heurck in having no concavity at the center, in the size of the beading, and in the central area being the full width of the valve.

Biddulphia setigera (Bail.) Mann.

Triceratium spinosum Bail. Am. Journ. Sci. **46**: 139. *pl. 3. f. 12.* 1844. Pritch. Hist. Infus. ed. 4. 853. *pl. 6. f. 19.* 1861. Schmidt, Atlas *pl. 87. f. 2–5, 7, 13–15.* 1885.

Triceratium setigerum Bail. Smithson. Contr. Knowl. **7**: 11. *f. 26.* 1854.

Triceratium armatum Roper, Quart. Journ. Micr. Sci. **2**: 283. *f. 1.* 1854; **4**: 274. *pl. 17. f. 9–12.* 1856. Moeb. Diat.-taf. *pl. 9. f. 9–12.* 1890. W. Smith, Synop. Brit. Diat. **2**: 87. 1856. Cleve, Bih. Sv. Vet. Akad. Handl. **5**^{8}: 15. 1878. Castr. Rep. Voy. Chall. Bot. **2**: 109. *pl. 6. f. 2.* 1886.

Triceratium serratum Wall. Quart. Journ. Micr. Sci. **6**: 243. *pl. 12. f. 1–3.* 1858. Pritch. Hist. Infus. ed. 4. 855. 1861. Moeb. Diat.-taf. *pl. 16. f. 1–3.* 1890. De Toni, Syll. Alg. **2**: 973. 1894, as synonym of Amphitetras.

Biddulphia spinosa Boyer, Proc. Acad. Phila. **1900**: 703. 1901.

From the above are excluded some forms united by other authors. The variety named *ornata* by Grove & Sturt[f] is not at all like this species, but is nearer *Triceratium ornatum* Shadb., as the authors suggest. But it possibly represents a new species.

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[a] Grun. Reise Novara Bot. **1**: 23. 1870.

[b] Schmidt, Atlas *pl. 122. f. 30.* 1888.

[c] Pritch. Hist. Infus. ed. 4. 848. 1861.

[d] Hedwigia **2**: 45. *pl. 7. f. 21.* 1860.

[e] Van Heur. Synop. *pl. 100. f. 11–14.* 1881.

[f] Journ. Quek. Micr. Club II. **2**: 329. *pl. 19. f. 20.* 1886.

Triceratium tridactylum Bright.[a] has long-attenuated processes, delicate reticulation, and a strikingly distinct border. Ralfs, De Toni, and Boyer unite it with the above, but Schmidt and others consider them distinct. I agree with this latter view. I also exclude *T. pileus* Ehrenb.,[b] which Schmidt [c] looks upon as synonymous with *T. spinosum* Bail. The resemblance is not worth considering. Grunow's claim that *T. spinosum* Bail. is only a triangular form of *Biddulphia granulata* Roper is equally untenable. The borders are very different, and the whole build of *B. granulata*, especially its reticulation, is much finer and more delicate than in *T. spinosum*.

As the name *Biddulphia spinosa* has been applied by Greville[d] to a quite different diatom and as I consider Grunow's assignment of this species of Greville's to Denticella [e] to be made on inadequate grounds, the original specific name of Bailey is preempted, and the choice lies between Bailey's *T. setigerum* and Roper's *T. armatum*. Both were published in 1854; but as Bailey's article appeared in February and Roper's somewhere near the close of the year, I have selected the name assigned by Bailey. My form is a large and elegant variety of this variable species. It shows a distinct inner triangular area symmetrical with the outer triangle, its reticulation showing no radiation; but outside of this triangle the reticulation is radial, running vertically to the edge, while a few rows of the network form broad lines running from each apex of the inner triangle to the base of each horn-like process in the angles of the outer triangle. No suture exists between these various portions of the valve, but the pattern is made very evident by the arrangement of the reticulation.

Found at station 2807, Galapagos Islands.

Biddulphia shadboltiana (Grev.) Mann.

Triceratium ? gibbosum Harv. & Bail. Proc. Acad. Phila. **6**: 181. *pl. 9. f. 32.* 1853; **7**: 430. 1854. Schmidt, Atlas *pl. 80. f. 13–15, 17, 21.* 1882.

Triceratium orbiculatum Shadb. err. det. Bright. Quart. Journ. Micr. Sci. **4**: 276. *pl. 17. f. 20.* 1856.

Triceratium shadboltianum Grev. Trans. Micr. Soc. Lond. n. s. **10**: 28. 1862. Van Heur. Synop. *pl. 108. f. 5–7.* 1881. Schmidt, Atlas *pl. 80. f. 18–20.* 1882. De Toni, Syll. Alg. **2**: 954. 1894.

Triceratium elongatum Grun. in Schmidt, Atlas *pl. 80. f. 12.* 1882.

Lampriscus kittoni Schmidt, Atlas *pl. 80. f. 11.* 1882.

I think there is sufficient ground for rejecting *Triceratium orbiculatum* Shadb. in connection with this species. Greville explains with care [f] that Brightwell confused another form with the original *T. orbiculatum* of Shadbolt. This is borne out by Shadbolt's description and figure,[g] the figure being reproduced by Moebius.[h] Shadbolt mentions no spines, and they are omitted from the figure by Tuffin West, which clearly argues they were not there. It is true, as Boyer [i] has pointed out, that Brightwell's species may be with or without spines, a statement that I can confirm. But though Brightwell's species may resemble Shadbolt's in not having spines, that does not mean that Shadbolt's species resembles Brightwell's further than in this negative quality. Greville, in conferring the name *shadboltianum* on the misnamed species of Brightwell, clearly emphasizes their differences and Ralfs [j] repeats this distinction.

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[a] Quart. Journ. Micr. Sci. **1**: 248. *pl. 4. f. 3.* 1853.

[b] Ehrenb. Mikrog. *pl. 19. f. 18.* 1854.

[c] Schmidt, Atlas *pl. 87. f. 18.* 1885.

[d] Trans. Micr. Soc. Lond. n. s. **13**: 6. *pl. 1. f. 3.* 1865.

[e] Denkschr. Akad. Wien **48**^{2}: 58. 1884.

[f] Trans. Micr. Soc. Lond. n. s. **10**: 28. 1862.

[g] Trans. Micr. Soc. Lond. n. s. **2**: 14. *pl. 1. f. 6.* 1854.

[h] Moeb. Diet.-taf. *pl. 3. f. 6.* 1890.

[i] Proc. Acad. Phila. **1900**: 710. 1901.

[j] Pritch. Hist. Infus. ed. 4. 853. 1861.

Certainly so capable a delineator of the Diatomaceae as Tuffen West would not figure Shadbolt's species so differently from Brightwell's, in the matter of cellulation, if they were specifically near enough to be united. We can, of course, go only by the figure and description and by the opinions of Greville and Ralfs; but in the absence of type material to examine, I consider it best to drop Shadbolt's species out of this category and unite the other forms above enumerated under the name given by Greville.

Found at station 3698, off Honshu Island, Japan.

Biddulphia subjuncta Mann, sp. nov. PLATE XLVI, FIGURE 4.

Valve square, the angles rounded and the sides slightly concave; marking of large, flat bosses, oval or subsquare, radially arranged from the center, which is without hyaline area; central portion within a circle, one-half the diameter of the valve, flat, thence the valve slightly convex to the border; the four processes set at the extremity of the rounded angles, broad, nearly sessile, with heavy investing rings and tipped to an angle of 45° to the surface of the valve; each bead punctate with a strong central dot.

Width of valve, 0.063 mm.

Type in the U. S. National Museum, No. 590140, from station 2808, Galapagos Islands April 4, 1888; 634 fathoms, bottom of coral sand.

I am compelled to name this diatom, but do so reluctantly. It is one of a variable group already including many close species, which will need eventually to be revised and condensed when subsequent intermediate forms are discovered. At such time this species should probably disappear. In general markings it is like *Triceratium biquadratum* Jan.,[a] except for the unimportant difference of a circular instead of a quadrate arrangement of the central portion of the valve, a character made prominent in the name given by Janisch. But in addition to the minor differences in marking, the processes at the angles are very broad and sessile, like those figured in *T. elegans* Grev.,[b] a phase of Greville's species in rather too wide contrast to his own representation.[c] My specimen is, on the whole, nearest to an unnamed figure of Schmidt's.[d]

Biddulphia turgida (Ehrenb.?) W. Smith, Synop. Brit. Diat. **2**: 50. *pl. 62. f. 384.* 1856. Roper, Trans. Micr. Soc. Lond. n. s. **7**: 17. *pl. 2. f. 23.* 1859. Van Heur. Synop. 206. 1885. Boyer, Proc. Acad. Phila. **1900**: 711. 1901.

Denticella turgida Ehrenb. Ber. Akad. Wiss. Berl. **1840**: 207. 1841?

Cerataulus turgidus Ehrenb. Ber. Akad. Wiss. Berl. **1843**: 271. 1844. Bail. Smithson. Contr. Knowl. **2**^{8}: 39. *pl. 2. f. 26–27.* 1851. Pritch. Hist. Infus. ed. 4. 846. *pl. 6. f. 9.* 1861. Schmidt, Atlas *pl. 115. f. 12–14*, *pl. 116. f. 1–3.* 1888. Castr. Rep. Voy. Chall. Bot. **2**: 101. *pl. 26. f. 6, 8.* 1886. Rabh. Fl. Cur. Alg. **1**: 313. 1864.

Odontella turgida Van Heur. Synop. *pl. 104. f. 1–2.* 1881. De Toni, Syll. Alg. **2**: 864. 1894.

The specimens found at station 3694H are quite small and wholly destitute of the two long spines.

Found at stations 3694H, 3712H, Okhotsk Sea.

ISTHMIA Ag.

Isthmia C. Ag. Consp. Diat. 55. 1832. Ehrenb. Infus. 208. 1838. Kütz. Bacill. 137 1844. W. Smith, Synop. Brit. Diat. **2**: 51. 1856. Cleve, Bih. Sv. Vet. Akad. Handl. 1^{13}: 10. 1873. O'Meara, Proc. Roy. Irish Acad. II. **2**: 279. 1875. Pritch. Hist. Infus. ed. 4. 851. 1861. De Toni, Syll. Alg. **2**: 833. 1894. Van Heur. Treat. Diat. 451. *f. 175.* 1896.

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[a] Schmidt, Atlas *pl. 98. f. 4.* 1886.

[b] Schmidt, Atlas *pl. 99. f. 10–11.* 1886.

[c] Trans. Micr. Soc. Lond. n. s. **14**: 9. *pl. 2. f. 24.* 1866.

[d] Schmidt, Atlas *pl. 99. f. 23.* 1886.

Diatoma D C., in part; Lyngb. Hydro. Dan. 181. 1819. C. Ag. Syst. Alg. 6. 1824.
Biddulphia S. F. Gray, Nat. Arr. **1**: 294, 1821, in part.
Isthmiella Cleve, Bih. Sv. Vet. Akad. Handl. 1^{13}: 10. 1873. De Toni, Syll. Alg. **2**: 834. 1894.

The restriction of the above genus by Cleve (see above) to the single species, *I. obliquata* (J. E. Smith.) Ehrenb., (*I. nervosa* Kütz.) and the forming of a new genus, Isthmiella, to include the species destitute of ribbing is wholly unwarranted, and has been followed by no one but De Toni in his Sylloge Algarum.

Isthmia obliquata (J. E. Smith.) Ehrenb. Infus. 209. *pl. 16. f. 5.* 1838. Ralfs, Ann. Mag. Nat. Hist. **12**: 272. *pl. 8. f. 2.* 1843.
Isthmia nervosa Kütz. Bacill. 137. *pl. 19. f. 5.* 1844. W. Smith, Synop. Brit. Diat. **2**: 52. *pl. 47.* 1856. Rabh. Beitr. **1**: 9. *pl. 4. f. 12.* 1863. O'Meara, Proc. Roy. Irish Acad. II. **2**: 279. *pl. 27. f. 15.* 1875. H. L. Smith, Sp. Diat. Typ. no. 206. 1874. Schmidt, Atlas *pl. 135. f. 1–6.* 1888. Pritch. Hist. Infus. ed. 4. 851. 1861. Van Heur. Treat. Diat. 452. *pl. 34. f. 891.* 1861. Grun. in Fenzl, Reise Novara Bot. **1**: 102. *pl. 1A. f. 21.* 1870.
Conferva obliquata J. E. Smith, Eng. Bot. **26**: *pl.* 1869. 1808, in part.
Diatoma obliquatum Lyng. Hydro. Dan. *pl. 62.* 1819, in part. C. Ag. Consp. Diat. 55. 1832.
Isthmia obliquata C. Ag. Consp. Diat. 55. 1832, in part. Kütz. Linnaea **8**: 579. *pl. 4. f. 59.* 1833.

Ehrenberg[a] was the first to separate the then single species of Isthmia into two, to the first of which, corresponding to what Kützing subsequently called *I. nervosa*, he gave the original specific name *obliquata*.[b] To the second he gave the name *enervis*.[c] The name *obliquata*, though recognized by some writers,[d] was generally dropped in favor of the more descriptive name of Kützing. Boyer, in attempting to reinstate *obliquata*, has done so at the expense of Ehrenberg's *enervis*, an arrangement quite impossible in view of Ehrenberg's descriptions and figures, Kützing's *nervosa* not having been proposed until 1844.[e]

It is remarkable how few specimens of this common marine diatom were met with in the dredgings and soundings examined for this report, especially as, on account of its large size and massive structure, it could not have been overlooked.

Found at stations 2844, 2848, 2851, 3200H, 4013H, 4530H, south of Alaska peninsula, off southern California and Honshu Island, Japan.

HEMIAULUS Ehrenb.

Hemiaulus Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 199, 203. 1845; Mikrog. *pl. 36. f. 43.* Char. emend. Heib. Krit. Overs. Danske Diat. 22, 43. 1863. Grev. Trans. Micr. Soc. Lond. n. s. **13**: 27. *pl. 3. f. 5–16.* 1865. De Toni, Syll. Alg. **2**: 836. 1892. Van Heur. Treat. Diat. 455. *f. 182–185.* 1896. Cf. H. L. Smith, The Lens **1**: 89. 1872. and Grun. Denkschr. Akad. Wien 48^{2}: 60. 1884. Boyer, Proc. Acad. Phila. **1900**: 738. 1901.
Corinna Heib. Krit. Overs. Danske Diat. 22, 53. *pl. 3. f. 8.* 1863.
Trinacria Heib. Krit. Overs. Danske Diat. 22, 50. *pl. 3. f. 7.* 1863. Witt, Verh. Russ. Min. Ges. II. **22**: 34. *pl. 11. f. 1–11.* 1886. De Toni, Syll. Alg. **2**: 854. 1894.

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[a] Ehrenb. Infus. 209. 1838.

[b] Op. cit. *pl. 16. f. 5.*

[c] Op. cit. *pl. 16. f. 6.*

[d] Ralfs, Ann. Mag. Nat. Hist. **12**: 272. 1843. Lagerst. Bih. Sv. Vet. Akad. Handl. 1^{14}: 16. 1873.

[e] Cf. Boyer, Proc. Acad. Phila. **1900**: 688, 689. 1901.

Rabh. Fl. Eur. Alg. 1: 317. 1864. Grun. Denkschr. Akad. Wien **48**^{2}: 67. 1884. Truan & Witt, Diat. Hayti 24. 1888.

Solium Heib. Krit. Overs. Danske Diat. 22, 52. *pl. 4. f. 10.* 1863. Grun. Denkschr. Akad. Wien **48**^{2}: 69. *pl 2. f. 61.* 1884. De Toni, Syll. Alg. **2**:860. 1894. Rabh. Fl. Eur. Alg. **1**: 319. 1864.

The original genus of Ehrenberg, though practically restored by Van Heurck by the inclusion of the three genera separated from it by Heiberg, contained some forms that would now be classed elsewhere. Thus *H. antarctica* Ehrenb.[a] is probably a Biddulphia. The grounds advanced by Heiberg for dividing the genus are of the most trivial character. As Grunow points out,[b] Trinacria and Solium are merely triangular and quadrangular examples of Hemiaulus; while Corinna differs simply in its frustules appearing wedge-shaped in zonal view. It may be added that certain species of Trinacria are indistinguishable from members of the loose genus Triceratium. The close relation of all these forms to the genus Biddulphia is evident; a fact strikingly illustrated by comparing *Hemiaulus polymorphus* Grun. with *Biddulphia elegantula* Grev.[c] The genus Ploiaria Pant., represented by the single species, *P. petasiformis* Pant.,[d] has great resemblance to Hemiaulus in the valval view; but when seen from the zonal view its somewhat concavo-convex form and its apices unprotruded and destitute of any spines, make its union here unnecessary.

Hemiaulus polycystinorum Ehrenb. Mikrog. *pl. 36. f. 43a–d.* 1854; Ber. Akad. Wiss. Berl. **1855**: 299. 1856; Phys. Abh. Akad. Wiss. Berl. **1875**: 52. *pl. 1. f. 12–15.* 1876. Grun. Denkschr. Akad. Wien **48**^{2}: 65. *pl. 2. f. 43–45.* 1884. Schmidt, Atlas *pl. 143. f. 23–29.* 1889. Pritch. Hist. Infus. ed. 4. 851. 1861. De Toni, Syll. Alg. **2**: 849. 1894. Boyer, Proc. Acad. Phila. **1900**: 740. 1901.

Hemiaulus antarcticus Weisse in Witt, Verh. Russ. Minn. Ges. II. **22**: 39. *pl. 6. f. 1–2.* 1886, not Ehrenb.

Found at station 4029H, Bering Sea.

PLOIARIA Pant.

Ploiaria Pant. Beitr. Bacill. Ung. **2**: 84. *pl. 28. f. 403, 405.* 1889. De Toni, Syll. Alg. **2**: 860. 1894. Van Heur. Treat. Diat. 457. *f. 186.* 1896. Boyer, Proc. Acad. Phila. **1900**: 741. 1901.

Hemiaulus Ehrenb. in part; Pant. Beitr. Bacill. Ung. **1**: 50. *pl. 29. f. 295.* 1886.

The separation of this genus from Hemiaulus appears to me justified. The single species at present known differs from any species of Hemiaulus in several respects. In the zonal view the frustule is strongly concavo-convex and the apices are destitute of vertical projections tipped with a claw. The center of the valve on one side is raised into a strong dome almost or entirely wanting on the other valve. In the valval view this central area is seen to be unseparated from the rest of the valve by rectangular boundary lines, such as appear in the similar form of Hemiaulus, known as *Corinna excavata* Heib. So far as I know, the genus is exclusively fossil, and I have heard of no cases where the frustules occur in connected series, as they do in Hemiaulus.

Ploiaria petasiformis Pant. Beitr. Bacill. Ung. **2**: 84. *pl. 28. f. 403, 405.* 1889. De Toni, Syll. Alg. **2**: 860. 1894. Van Heur. Treat. Diat. 457. *f. 186.* 1896. Boyer, Proc. Acad. Phila. **1900**: 742. 1901.

Hemiaulus petasiformis Pant. Beitr. Bacill. Ung. **1**: 50. *pl. 29. f. 295.* 1886.

Found at station 4029H, Bering Sea.

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[a] Ehrenb. Mikrog. *pl. 35A. XXI. f. 13–15, XXII. f. 15.* 1854.

[b] Denkschr. Akad. Wien **48**^{2}: 60. 1884.

[c] Schmidt, Atlas *pl. 143. f. 34.* and *pl. 119. f. 10.*

[d] Pant. Beitr. Bacill. Ung. **2**: 84. *pl. 28. f. 403, 405.* 1889.

TERPSINOE Ehrenb.

Terpsinoe Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 402. *pl. 3. IV. f. 1, VII. f. 30.* 1843. Kütz. Bacill. 128. *pl. 30. f. 72.* 1844; Sp. Alg. 119. 1849. Pritch. Hist. Infus. ed. 4. 859. *pl. 11. f. 47.* 1861. Grun. in Fenzl, Reise Novara Bot. **1:** 23. 1870. De Toni, Syll. Alg. **2:** 894. 1894. Boyer, Proc. Acad. Phila. **1900:** 732. 1901.

Pleurodesmium Kütz. Bot. Zeit. 248. 1846. De Toni, Syll. Alg. **2:** 896. 1894. Kütz. Sp. Alg. 115. 1849.

Tetragramma Bail. Smithson. Contr. Knowl. **7:** 7. *f. 1.* 1854.

Hydrosera Wall. Quart. Journ. Micr. Sci. **6:** 251. *pl. 13.* 1858.

Triceratium Ehrenb. in part; Cleve, Bih. Sv. Vet. Akad. Handl. **18**^{5}**:** 24. *pl. 6. f. 75.* 1881.

This genus, though showing marked similarity to both Anaulus Ehrenb. and Porpeia Bail. and, therefore, more remotely to Biddulphia Gray, is clearly distinct. Its identity with the three genera enumerated in the synonymy is generally recognized, though De Toni and a few others preserve the separate rank of Pleurodesmium and Hydrosera. In regard to the former it is sufficient to note that the only striking difference is its finer beading of the middle band (zonal view) and coarser beading of the lateral bands, and we find in *T. intermedia* Grun., an otherwise typical *T. musica*, the beading of *Pleurodesmium brebissonii* Kütz., so that, as Grunow says,[a] the two genera are certainly the same. The genus Tetragramma was made on such insufficient distinctions that Bailey himself afterwards abandoned it.[b] Hydrosera even in its usual triangular form shows the music notes and all the characteristics of Terpsinoe.

Terpsinoe musica Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 402. *pl. 3. IV. f. 1, VII. f. 30.* 1843; Mikrog. *pl. 34. V. A. f. 10, VI. A. f. 8–8*, VI. B. f.* 2. 1854. Kütz. Bacill. 128. *pl. 30. f. 72.* 1844. Pritch. Hist. Infus. ed. 4. 859. *pl. 11. f. 47.* 1861. L. W. Bail. Bost. Journ. Nat. Hist. **7:** 340. *pl. 8. f. 52–53.* 1862. Griff. & Henf. Micr. Dict. ed. 4. 759. *pl. 19. f. 33, pl. 25. f. 10.* 1883. Wolle, Diat. N. A. *pl. 61. f. 6, 13–15.* 1890. De Toni, Syll. Alg. **2:** 894. 1894. Boyer, Proc. Acad. Phila. **1900:** 732. 1901. Schmidt, Atlas *pl. 199. f. 9–13, pl. 200. f. 7–8.* 1895. H. L. Smith, Sp. Diat. Typ. no. 590. 1874.

Tetragramma americana Bail. Smithson. Contr. Knowl. **7:** 7. *f. 1.* 1854.

Terpsinoe javanensis Ehrenb. Mikrog. *pl. 34. VIII. f. 16.* 1854.

Terpsinoe americana Ralfs in Pritch. Hist. Infus. ed. 4. 859. 1861. Grun. in Fenzl, Reise Novara Bot. **1:** 23. 1870. Schmidt, Atlas *pl. 200. f. 9–13.* 1895. De Toni, Syll. Alg. **2:** 895. 1894. Boyer, Proc. Acad. Phila. **1900:** 734. 1901.

Terpsinoe magna Bail. Bost. Journ. Nat. Hist. **7:** 340. *pl. 8. f. 46.* 1862. Wolle, Diat. N. A. *pl. 61. f. 7.* 1890. De Toni, Syll. Alg. **2:** 896. 1894.

Terpsinoe tetragramma Bail. Bost. Journ. Nat. Hist. **7:** 340. *pl. 8. f. 50–51.* 1862. Wolle, Diat. N. A. *pl. 61. f. 8–9.* 1890. De Toni, Syll. Alg. **2:** 896. 1894.

Terpsinoe minima Bail. Bost. Journ. Nat. Hist. **7:** 340. *pl. 8. f. 54.* 1862. Wolle, Diat. N. A. *pl. 61. f. 12* (poor). 1890.

Terpsinoe intermedia Grun. Denkschr. Akad. Wien **48**^{2}**:** 59. 1884. Kain & Schultze, Bull. Torr. Club **16:** 209. *pl. 93. f. 2.* 1889. Schmidt, Atlas *pl. 198. f. 65.* 1877; *pl. 199. f. 1–8, pl. 200. f. 1–6.* 1895. Boyer, Proc. Acad. Phila. **1900:** 733. 1901. De Toni, Syll. Alg. **2:** 895. 1894.

Terpsinoe japonica Ehrenb.; De Toni, Syll. Alg. **2:** 895. 1894.

It may also be necessary to consider *Hydrosera triquetra* Wall.[c] as merely a triangular variety of this species, in which case the following would also belong here, as they are synonymous with *H. triquetra*: *H. compressa* Wall.,[a] *H. mauritiana* Berger,[b] *H. boryana* Pant.[c] *Triceratium javanicum* Cleve.[d] But there is doubt whether these belong here. They would be very widely divergent varieties, and it seems best to leave them in a combination by themselves under the specific name *triquetra*. *T.* (*Pleurodesmium*) *brebissonii* Kütz., though an evident Terpsinoe, is also in strong enough contrast to stand specifically. I have based this conclusion on a careful comparison of the two species in H. L. Smith's type no. 388 (*P. brebissonii*) and no. 590 (*T. musica*) and on the agreement of these with the figures of Ralfs in Pritchard's History of Infusoria.[e]

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[a] Denkschr. Akad. Wien **48**^{2}**:** 59. 1884.

[b] Bost. Journ. Nat. Hist. **7:** 340. 1862.

[c] Quart. Journ. Micr. Sci. **6:** 251. *pl. 13. f. 1–6.* 1858.

Found at station 2807, Galapagos Islands.

PORPEIA Bail.

Porpeia Bail.; Pritch. Hist. Infus. ed. 4. 850. *pl. 6. f. 6.* 1861. Rabh. Fl. Eur. Alg. **1**: 315. 1864. Grev. Trans. Micr. Soc. Lond. n. s. **13**: 52. *pl. 6. f. 18–21.* 1865. De Toni, Syll. Alg. **2**: 893. 1892. Van Heur. Treat. Diat. 477. *f. 208.* 1896. Boyer, Proc. Acad. Phila. **1900**: 731. 1901.

This genus is a connecting link between Biddulphia Gray and Hemiaulus Ehrenb. Its difference from the former is largely a matter of greater massiveness of frustule and the internal septa; its difference from the latter is in the absence of straight or curved spines at the ends of its processes and in its septa. In fact, a study of the zonal view of these genera will show how little is needed to turn one into the other. Schmidt in his Atlas[f] has figured a species which, as he says, is highly interesting, a Hemiaulus-Porpeia with a rudimentary curved spine at the end of each process. Or, if we take figure 42 of the same plate and broaden laterally its central elevation till it presses on the two processes, we have a Porpeia, and the two sutures between the central area and the processes reproduce exactly the septa of Porpeia. But though this genus could in a broad sense be united with either of the other two, Hemiaulus could not be included in Biddulphia without abandoning entirely our present conception of it. For classification it is, therefore, certainly best to retain this genus, as is universally done.

Porpeia quadriceps Bail.; Pritch. Hist. Infus. ed. 4. 850. *pl. 6. f. 6.* 1861. Van Heur. Synop. *pl. 95bis. f. 12–14.* 1881. Grev. Trans. Micr. Soc. Lond. n. s. **13**: 52. *pl. 6. f. 18–19* (*pl. 8. f. 13* doubtful). 1865. Schmidt, Atlas *pl. 142. f. 38, 46–56.* 1889. Van Heur. Treat. Diat. 477. 1896. De Toni, Syll. Alg. **2**: 893. 1894. Moeb. Diat.-taf. *pl. 67. f. 18–19.* (*pl. 68. f. 13* doubtful). 1881. Wolle, Diat. N. A. *pl. 66. f. 25* (*f. 30* doubtful). 1890. Boyer, Proc. Acad. Phila. **1900**: 731. 1901.

Porpeia quadrata Grev. Trans. Micr. Soc. Lond. n. s. **13**: 53. *pl. 6. f. 20.* 1865. Moeb. Diat.-taf. *pl. 67. f. 20.* 1890. De Toni, Syll. Alg. **2**: 893. 1894. Van Heur. Synop. *pl. 95bis. f. 15.* 1881; Treat. Diat. 477. *f. 208.* 1896. Wolle, Diat. N. A. *pl. 66. f. 33.* 1890. Boyer, Proc. Acad. Phila. **1900**: 732. 1901.

Porpeia ornata Grev. Trans. Micr. Soc. Lond. n. s. **13**: 53. *pl. 6. f. 21.* 1865. Moeb. Diat.-taf. *pl. 67. f. 21.* 1890. De Toni, Syll. Alg. **2**: 894. 1894.

Porpeia robusta Truan & Witt, Diat. Hayti 18. *pl. 3. f. 23.* 1880? De Toni, Syll. Alg. **2**: 894. 1894.

Porpeia inflexa Schmidt, Atlas *pl. 142. f. 58.* 1889.

I think Schmidt does rightly in combining his fourteen figures above cited under this single species. They practically are identical; figure 47 is what Greville calls *P. quadrata*, and his figures 54 and 56 are Greville's *P. ornata*. But I can see no reason for the separation by Schmidt of his *P. inflexa*. There is but little doubt of *P. robusta* belonging here; the slight difference in beading amounts to nothing, as this species is most variable in that respect, and the lighter and more curved septa appear to me unimportant. I have, however, followed this synonym with a question mark.

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[a] Op. cit. 252. *pl. 13. f. 7–12.*

[b] Le Diatomiste **1**: 31. *pl. 51. pl. 5. f. 8.* 1890.

[c] Pant. Beitr. Bacill. Ung. **2**: 82. *pl. 30. f. 420, 423.* 1889.

[d] Bih. Sv. Vet. Akad. Handl. **18**^{5}: 24. *pl. 6. f. 75.* 1881.

[e] Ed. 4. 859, *pl. 11. f. 47.* 1861.

[f] *Pl. 142 f. 57.*

Found at station 2807, Galapagos Islands.

HEMIDISCUS Wall.

Hemidiscus Wall. Trans. Micr. Soc. Lond. n. s. **8**: 42. *pl. 2. f. 3-4*. 1860. Pritch. Hist. Infus. ed. 852. 1861.

Euodia Bail.; Pritch. Hist. Infus. ed. 4. 852. 1861. Rabh. Fl. Eur. Alg. **1**: 317. 1864. Castr. Rep. Voy. Chall. Bot. **2**: 148. 1886. Van Heur. Treat. Diat. 538. 1896. De Toni, Syll. Alg. **2**: 1324. 1894. H. L. Smith, The Lens **1**: 92. 1872.

Dichomeris Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1861**: 294. 1862; **1872**: 265. *pl. 9. f. 8*. 1873.

Palmeria Grev.; Grev. Ann. Mag. Nat. Hist. III. **16**: *pl. 5. f. 1-4*. 1865. Van Heur. Treat. Diat. 538. *f. 286*. 1896. H. L. Smith, Sp. Diat. Typ. no. 387. 1874.

Goniothecium Ehrenb. Mikrog. *pl. 33. XVIII. f. 4*. 1854, in part. Griff. & Henf. Micr. Dict. ed. 3. 347. *pl. 42. f. 18*. 1875.

Most diatomists have retained the name Euodia Bailey, notwithstanding the fact that Hemidiscus of Wallich is a year older. Besides this objection to the name there is a still stronger one in the fact that the name Euodia was used by Forster in 1776 for a genus of flowering plants of the family Rutaceae. That Euodia Bailey and Hemidiscus Wall. are synonymous is certain, the only mark of distinction being the pseudonodule observed near the ventral margin of the valve by Wallich. As Ralfs remarks,[a] this may have been overlooked by Bailey; or, as is more likely, it was absent from his specimen. It is not infrequent to find the same forms with or without the pseudonodule, or to find a complete frustule with one valve bearing a pseudonodule and the other lacking it. It is also impossible to hold Greville's Palmeria as a separate genus. The indefinite hyaline central area is the only real difference it possesses, a characteristic too trivial to warrant its separation, as on the same basis we should have to divide many other genera, such as Coscinodiscus. The other quality claimed for Palmeria, namely, fine submarginal spines, with lines from these running radially to the center, is not at all peculiar to Greville's specimen. Wallich refers to the marginal processes as "marginal puncta" and figures them on the dorsal side. A careful examination of Greville's Palmeria in the excellent specimens of H. L. Smith's type slides no. 387 convinces me it is without the distinctions necessary for separate generic rank; though it should be classed as a separate species, viz, *Hemidiscus hardmanianus* (Grev.) Mann.[b] On the other hand, it should be here noted that the striking build of the members of this genus leads to the too easy conclusion that all cuneiform frustules bearing a reasonably close resemblance to the original species, *Hemidiscus cuneiformis* Wall., must be mere varieties of it. Of course such a conclusion would be no more justified than to look upon all circular diatoms covered with a delicate, radially arranged network of hexagons as varieties of *Coscinodiscus radiatus* Ehrenb. I have, therefore, below given to two specimens found by me the separate specific names bestowed by Castracane, although their general similarity to Wallich's original form is apparent.

Hemidiscus cuneiformis Wall. Trans. Micr. Soc. Lond. n. s. **8**: 42. *pl. 2. f. 3-4* 1860. Moeb. Diat.-taf. *pl. 31. f. 3-4*. 1890. Pritch. Hist. Infus. ed. 4. 853. *pl. 6. f. 14*. 1861.

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[a] Pritch. Hist. Infus. ed. 4. 853. 1861.

[b] *Euodia hardmaniana* (Grev.) H. L. Smith; Hab. Cat. 132. 1877.

Euodia gibba Bail.; Pritch. Hist. Infus. ed. 4. 852. *pl. 8. f. 22.* 1861. H. L. Smith, Sp. Diat. Typ. no. 161. 1874. Rabh. Fl. Eur. Alg. **1**: 318. 1864. De Toni, Syll. Alg. **2**: 1325. 1894. Van Heur. Treat. Diat. 538. *f. 285.* 1896. Wolle, Diat. N. A. *pl. 68. f. 26.* 1890.

Dichomeris subtilis Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1861**: 294. 1862; **1872**: 265. *pl. 9. f. 8.* 1873.

Euodia inornata Castr. Rep. Voy. Chall. Bot. **2**: 149. *pl. 12. f. 1.* 1886?

The last name above is doubtful. It agrees very closely with Wallich's figure, but is a larger diatom with finer markings. I do not include here Ehrenberg's *Goniothecium anaulus*.[a] Though plainly a member of this genus, it is not easily united with this species.[b] It is evidently a very coarsely marked form. Habirshaw, though placing it with the above, questions it. Without an accurate description, which it lacks, I consider its union here somewhat arbitrary and illustrative of the tendency mentioned above, to blend all similar forms with the original species of Wallich.

Hemidiscus rectus (Castr.) Mann.

Euodia recta Castr. Rep. Voy. Chall. Bot. **2**: 149. *pl. 12. f. 3.* 1886. De Toni, Syll. Alg. **2**: 1326. 1894.

My specimens of this very large diatom have more evidently radial markings than the above figure.

Found at stations 2919, 2923, off southern California.

Hemidiscus ventricosus (Castr.) Mann.

Euodia ventricosa Castr. Rep. Voy. Chall. Bot. **2**: 150. *pl. 12. f. 5.* 1886. De Toni, Syll. Alg. **2**: 1326. 1894.

There is a possible doubt about this being more than a large and delicately marked variety of *H. cuneiformis* Wall. But after comparing my specimens with those of that species from several localities I have found the contrast too wide to admit of making them synonymous.

Found at station 2920H, Hawaiian Islands.

RUTILARIA Grev.

Rutilaria Grev. Quart. Journ. Micr. Sci. n. s. **3**: 227. *pl. 9. f. 1-3.* 1863. Grev. Trans. Micr. Soc. Lond. n. s. **14**: 124. *pl. 11. f. 9-12.* 1866. Cleve, Bih. Sv. Vet. Akad. Handl. **18**^{5}: 19. 1881 (exclusive of *R. recens* Cleve). De Toni, Syll. Alg. **2**: 1020. 1894. Van Heur. Treat. Diat. 433. *f.* 136. 1896.

The attempt to see a relationship between this genus and Nitzschia, as suggested by Greville, or between it and Melosira, as suggested by H. L. Smith, or between it and Cymatosira, mentioned in that view by Cleve, appear all of them rather far-fetched.

Rutilaria epsilon (Kitton) Grev. Quart. Journ. Micr. Sci. n. s. **3**: 228. *pl. 9. f. 1.* 1863. Moeb. Diat.-taf. *pl. 47. f. 1.* 1890. Gr. & St. Journ. Quek. Micr. Club II. **3**: 74 *pl. 6. f. 13.* 1887. De Toni, Syll. Alg. **2**: 1021. 1894. Temp. & Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **31**^{1}: 55. *pl. 1. f. 12.* 1891.

Nitzschia epsilon Kitton, Quart. Journ. Micr. Sci. n. s. **3**: 228. 1863, as synonym.

Rutilaria tenuicornis Grun.; Van Heur. Synop. *pl. 105. f. 10.* 1881.

Rutilaria longicornis Temp. & Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **31**^{1}: 54. *pl. 1. f. 1.* 1891. Van Heur. Treat. Diat. 433. *f. 156.* 1896. De Toni, Syll. Alg. **2**: 1021. 1894. Pant. Beitr. Bacill. Ung. **3**: *pl. 33. f. 478.* 1893.

Rutilaria hexagona Grun.; Van Heur. Synop. *pl. 105. f. 8.* 1881. Temp. & Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **31**^{1}: 55. *pl. 1. f. 2.* 1891.

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[a] Ehrenb. Mikrog. *pl. 33, XVIII, f. 4.* 1854.

[b] Cf. Griff. & Henf. Micr. Dict. ed. 3. 347, *pl. 42. f. 18.* 1875.

Rutilaria szakalensis Pant. Beitr. Bacill. Ung. **2**: 76. *pl. 24. f. 355.* 1889. De Toni, Syll. Alg. **2**: 1023. 1894.

Rutilaria kernerii Pant. Beitr. Bacill. Ung. **3**: *pl. 33. f. 474.* 1893. De Toni, Syll. Alg. **2**: 1024. 1894.

Rutilaria capitata Temp. & Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **31**^{1}: 54. *pl. 1. f. 3a–b.* 1891. De Toni, Syll. Alg. **2**: 1022. 1894. Pant. Beitr. Bacill. Ung. **3**: *pl. 33. f. 473.* 1893.

Rutilaria radiata Gr. & St. Journ. Quek. Micr. Club II. **2**: 322. *pl. 18. f. 4–5.* 1886.

Rutilaria edentula Castr. Rep. Voy. Chall. Bot. **2**: 92. *pl. 18. f. 14.* 1886.

Rutilaria obesum Grev.; Cleve. Bih. Sv. Vet. Akad. Handl. **18**^{5}: 19. 1881?.

Rutilaria superba Grev. Trans. Micr. Soc. Lond. n. s. **14**: 125. *pl. 11. f. 11–12.* 1866. Moeb. Diat.-taf. *pl. 74. f. 11–12.* 1890. De Toni, Syll. Alg. **2**: 1022. 1894?

Rutilaria elliptica Grev. Quart. Journ. Micr. Sci. n. s. **3**: 229. *pl. 9. f. 3.* 1863. Moeb. Diat.-taf. *pl. 47. f. 3, pl. 74. f. 9–10.* 1890. Trans. Micr. Soc. Lond. n. s. **14**: 125. *pl. 11. f. 9–10.* 1866. De Toni, Syll. Alg. **2**: 1022. 1894?

Rutilaria ventricosa Grev. Quart. Journ. Micr. Sci. n. s. **3**: 228. *pl. 9. f. 2.* 1863. Pant. Beitr. Bacill. Ung. **1**: 44. *pl. 9. f. 78.* 1886. Moeb. Diat.-taf. *pl. 47. f. 2.* 1890. De Toni, Syll. Alg. **2**: 1022. 1894?

This species is subject to great variation. A good gathering will show nearly all the forms represented by the above names, together with intergradations. *R. radiata*, if judged from the figure alone, would seem quite distinct, but interpreting the lines as rows of beads, as we learn from the diagnosis that they are, we see that we have to do with an unimportant variety of the above. It is practically identical with *R. edentula* Castr. There is some doubt as to the worth of the last three names with the authority of Greville, but a comparison of the forms represented by these with all the above will indicate that they are probably varieties. I have followed the names with a question mark. The doubt over *R. obesum* is due to the lack of a figure. So far as can be made out it belongs here.

Found at Station 4029H, Bering Sea.

DENTICULA Kütz.

Denticula Kütz. Bacill. 43. (not *pl. 3. f. 60 a-b*). 1844. Char. emend. Grun. Verh. Zool. Bot. Ges. Wien **12**: 546. 1862. Pritch. Hist. Infus. ed. 4. 773. *pl. 13. f. 4.* 1861. Van Heur. Synop. 159. *pl. 49. f. 1–38.* 1881. Rabh. Fl. Eur. Alg. **1**: 12, 114. *f. 30.* 1864. De Toni, Syll. Alg. **2**: 557. 1892. W. Smith, Synop. Brit. Diat. **2**: 19. *pl. 34. f. 292–295.* 1856. Griff. & Henf. Micr. Dict. ed. 3. 230. *pl. 12. f. 25.* 1875. Brun, Diat. Alp. 112. *pl. 3. f. 34, 36–37.* 1880 (not Trans. Roy. Soc. Edinb. **21**: 495. *pl. 10. f. 34–36, 38–39* (except *f. 37*). 1857; Verh. Zool. Bot. Ges. Wien **12**: 548. *pl. 12. f. 15.* 1862).

Eunotia Ehrenb. Mikrog. *pl. 34. V. B. f. 7–8.* 1854, in part.

Odontidium Kütz. in part; O'Meara, Proc. Roy. Irish Acad. II. **2**: 288. 1875.

The genus as originally defined by Kützing is very indefinitely bounded and contains members of several other genera. Grunow's emendation is also quite faulty, as he lost sight of the true transverse character of the strong costae and thereby opened the way for costae on only one side of the valve; in other words, short and broad forms of Nitzschia. The genus is well marked by Van Heurck,[a] and the illustrations, which include all the figures of plate 49, are consistent and decisive. Its nearest relative is Diatoma (DC.) Heib., from which it is easily distinguished by the absence of an evident hyaline median line on the valves ("pseudoraphe"), by its rounded, unconstricted apices, and, in the zonal view, by the costae terminating near the girdle in enlarged or beaded ends. Its type species, *D. tenuis* Kütz., well represents the characteristics of the genus.

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[a] Van Heur. Synop. 159. 1885.

Denticula nicobarica Grun. in Fenzl, Reise Novara Bot. **1**: 97. *pl. 1A. f. 5.* 1870. Van Heur. Synop. *pl. 49. f. 3.* 1881.

This minute diatom is most plentiful in the following single sounding.

Found at station 3635H, Bering Sea.

GRAMMATOPHORA Ehrenb.

Grammatophora Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1839**: 112, 152. 1841. Pritch. Hist. Infus. ed. 4. 807. *pl. 11. f. 48–49, 52–53.* 1861. Rabh. Fl. Eur. Alg. **1**: 26, 303. *f. 81.* 1864. Grun. Verh. Zool. Bot. Ges. Wien **12**: 413. 1862. Van Heur. Synop. 163. *pl. 53–53bis.* 1881; Treat. Diat. 353. *f. 105.* 1896. De Toni, Syll. Alg. **2**: 750. 1892. W. Smith, Synop. Brit. Diat. **2**: 42. *pl. 42.* Kütz. Bacill. 128. *pl. 17. f. 23–25.* 1844.

Disiphonia Ehrenb. Mikrog. *pl. 35A. II. f.* 7. 1854; Phys. Abh. Akad. Wiss. Berl. **1869**: 48. *pl. 2. II. f. 18.* 1870. Griff. & Henf. Micr. Dict. ed. 4. 267. *pl. 51. f. 16.* 1883.

Diatomella Grev. Ann. Mag. Nat. Hist. II. **15**: 259. *pl. 9. f. 10–13.* 1855. Pritch. Hist. Infus. ed. 4. 810. *pl. 4. f. 51, 52.* Grun. Verh. Zool. Bot. Ges. Wien **12**: 409. 1862. Brun. Diat. Alp. 129. *pl. 9. f. 13.* 1880. H. D. Smith, Sp. Diat. Typ. no. 650. 1874. Grun. in Fenzl, Reise Novara Bot. **1**: 5. 1870. Rabh. Fl. Eur. Alg. **1**: 3, 25. *f. 78.* 1864. Van Heur. Treat. Diat. 353. 1896. Lagers. Bih. Sv. Vet. Akad. Handl. **1**^{14}: 20. 1873. De Toni, Syll. Alg. **2**: 742. 1892.

Diatoma (DC.) Heib. in part; Lyng. Hydro. Dan. 180. *pl. 62A.* 1819.

Fragilaria Lyng. in part; Lyng. Hydro. Dan. 182. *pl. 62. E-F.* 1819.

Striatella C. Ag. in part; Ralfs, Ann. Mag. Nat. Hist. 1843. **11**: 457. *pl. 9. f. 5.* 1843.

There is great need of a capable monograph of this genus. Van Heurck's Synopsis gives two plates illustrating thirty species. Smith's British Diatoms illustrates superbly four species. Single species are scattered here and there through diatom literature. But the available figures are as a class poor and scanty. Owing to the delicate markings that characterize this genus, the earlier investigators, like Lyngbye, Agardh, and Ehrenberg, confused the species to an extreme extent. It is impossible to look upon Greville's genus Diatomella as anything more than a normally distinct species of Grammatophora. The main mark of distinction relied upon for separation, namely, the single straight septa as seen in zonal view, is neither confined to this species nor important enough, were it peculiar to it, to form a basis for a separate genus. Thus varieties of *G. undulata* Ehrenb., *G. arctica* Cleve, and *G. stricta* Ehrenb.[a] show the same quality. This characteristic, together with the extreme minuteness and delicacy of this form, mark it as a sharply distinct species, nothing more. Were, however, its generic status valid, it would necessarily take Ehrenberg's older name, Disiphonia, instead of that of Greville.

Grammatophora flexuosa Grun.; Van Heur. Synop. *pl. 53bis. f. 22–23.* 1881. Temp. & Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **309**: 71. 1889. De Toni, Syll. Alg. **2**: 759. 1892.

Found at station 3013H, Hawaiian Islands.

Grammatophora lyrata Grun.; Van Heur. Synop. *pl. 53bis. f. 21.* De Toni, Syll. Alg. **2**: 759. 1892. Cleve & Moll. type no. 162.

My specimen agrees with the type, except that the lyrate valves are much less strongly undulated.

Found at station 2807, Galapagos Islands.

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[a] Cf. Castr. Rep. Voy. Chall. Bot. **2**: *pl. 29. f. 12.* 1886.

Grammatophora marina (Lyng.) Kütz. Bacill. 128. *pl. 17. f. 24* (not *pl. 18. f. I. 1-4*). 1844. Van Heur. Synop. 163. *pl. 53. f. 9-13.* 1881; Treat. Diat. 354. *pl. 11. f. 479-480a.* 1896. H. L. Smith, Sp. Diat. Typ. no. 188. 1874. Pritch. Hist. Infus. ed. 4. 808. *pl. 11. f. 52-53* (not *pl. 4. f. 47*). 1861. W. Smith, Synop. Brit. Diat. **2**: 42. *pl. 42. f. 314.* 1856. De Toni, Syll. Alg. **2**: 752. 1892. Rabh. Fl. Eur. Alg. **1**: 26, 303. *f. 81a-b.* 1864. Grun. Verh. Zool. Bot. Ges. Wien **12**: 415. 1862. Jan. Abh. Schl. Ges. Vaterl. Cult. **1862^{2}**: 8. *pl. 2B. f. 5.* 1862. O'Meara, Proc. Roy. Irish Acad. II. **2**: 515. *pl. 29. f. 1.* 1875. Griff. & Henf. Micr. Dict. ed. 4. 363. *pl. 16. f. 35* (not *pl. 1. f. 14*). 1883.

Diatoma marinum Lyng. Hydro. Dan. 180. *pl. 62A.* 1819.

Grammatophora mexicana Ehrenb. Phys. Abh. Akad. Wiss. Wien **1841**: 443. *pl. 3. VII. f. 32.* 1843. Kütz. Bacill. 128. *pl. 18. I. f. 6, pl. 29. f. 78.* 1844.

Fragilaria latruscularia Lyng. Hydro. Dan. 182. *pl. 62E.* 1819.

Fragilaria fasciata Lyng. Hydro. Dan. 182. *pl. 62F.* 1819.

I do not include in the above synonymy several species classed here by De Toni and others. Thus *Bacillaria cleopatrae* Ehrenb.[a] can not be accurately identified as belonging to this or any similar species of Grammatophora. Its figures and descriptions make any assignment mere guesswork. I also exclude *G. ovalauensis* Grun,[b] united with the above by De Toni; also *G. macilenta* W. Smith, united with the above by Grunow.[c] I look upon it, as does De Toni, as belonging under *G. oceanica* Ehrenb.[d]

Found at station 2848, Aleutian Islands.

Grammatophora maxima Grun. Verh. Zool. Bot. Ges. Wien **12**: 416. *pl. 8. f. 5.* 1882. Van Heur. Synop. *pl. 53bis. f. 12-13.* 1881. Cleve, in Nordensk. Vega Exped. **3**: 501, 508. 1883. De Toni, Syll. Alg. **2**: 754. 1892. Wolle, Diat. N. A. *pl. 49. f. 26.* 1890.

Grammatophora (*maxima* var.?) *ambigua* Grun.; Van Heur. Synop. *pl. 53bis. f. 14.* 1881.

This is possibly a variety of *G. stricta* Ehrenb. (=*G. parallela* Ehrenb.), as Grunow suggests. He refers to the valves as hyaline. By careful lighting they are seen to be covered with delicate lines in the three directions common to this species, that is, as in Gyrosigma.

Found at station 3688H, Okhotsk Sea.

Grammatophora stricta Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 298, 437, *pl. 1. I. f. 22, pl. 3. VII. f. 31.* 1843. Kütz. Bacill. 129. *pl. 29. f. 76.* Pritch. Hist. Infus. ed. 4. 808. 1861. Wolle, Diat. N. A. *pl. 49. f. 17* (not *f. 18*). 1890. H. L. Smith, Sp. Diat. Typ. no. 671. 1874. Truan & Witt, Diat. Hayti 16. *pl. 3. f. 7, 14.* 1888. Castr. Rep. Voy. Chall. Bot. **2**: 57. *pl. 29. f. 12.* 1886. Pant. Beitr. Bacill. Ung. **1**: 41. *pl. 26. f. 239, pl. 30. f. 307-309.* 1886.

Grammatophora tabellaria Ehrenb. Mikrog. *pl. 18. f. 89-90.* 1854. Pritch. Hist. Infus. ed. 4. 808. 1861.

Grammatophora parallela Ehrenb. Mikrog. *pl. 21. f. 26a-d, pl. 22. f. 63 a-b, pl. 33. XIV. f. 16, pl. 35A. XX. f. 3. pl. 39. II. f. 73.* 1854. Pritch. Hist. Infus. ed. 4. 808. 1861. Grun. Verh. Zool. Bot. Ges. Wien **12**: 417. 1862. Rabh. Fl. Eur. Alg. **1**: 305. 1864. De Toni, Syll. Alg. **2**: 754. 1892.

Grammatophora (*stricta* Ehrenb. var.?) *biharensis* Pant. Beitr. Bacill. Ung. **1**: 41. *pl. 30. f. 307-309.* 1886. De Toni, Syll. Alg. **2**: 755. 1892.

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[a] Ehrenb. Symb. Phys. Everteb. 5. *pl. 3, V. f. 2.* 1828; Infus. 199. *pl. 15. f. 3.* 1838.

[b] Van Heur. Synop. *pl. 53. f. 24-25.* 1881.

[c] Van Heur. Treat. Diat. 354. 1896.

[d] Cf. W. Smith, Synop. Brit. Diat. **2**: 43. *pl. 61. f. 382;* De Toni, Syll. Alg. **2**: 755. 1892.

Two references found in Ehrenberg's works should be excluded here.[a] In both of these cases Ehrenberg expresses doubt by an interrogation point. Grunow's selection of the specific name *parallela* over that of *stricta*, copied by De Toni, is inadmissible.

Found at station 2807, Galapagos Islands.

TESSELLA Ehrenb.

Tessella Ehrenb. Infus. 202. *pl. 20. f.* 7. 1838. In part (exclusive of Striatella forms, e. g. *Tesella arcuata* Ehrenb.). Ralfs, Ann. Mag. Nat. Hist. **12**: 104. *pl. 2. f. 1.* 1843 (not Ralfs in Pritch. Hist. Infus. ed. 4. 804. *pl. 8. f. 5;* not Kütz. nor O'Meara).

Striatella C. Ag. in part; Ralfs, Ann. Mag. Nat. Hist. **11**: 455. *pl. 9. f. 6.* 1843.

Rhabdonema Kütz. Bacill. 126. *pl. 21. II. f. 4*, *pl. 18. f. 6.* 1844. W. Smith, Synop. Brit. Diat. **2**: 32. *pl. 38.* 1853. Rabh. Fl. Eur. Alg. **1**: 305. 1864. Pritch. Hist. Infus. ed. 4. 804. 1861. Van Heur. Synop. 165. 1881; Treat. Diat. 360. *f. 111.* 1896. De Toni, Syll. Alg. **2**: 760. 1892. Grun. Verh. Zool. Bot. Ges. Wien **12**: 422. 1862.

This genus was constituted in 1838, though the name appears in literature in 1837.[b] As defined and figured by Ehrenberg it is truly synonymous with Kützing's Rhabdonema. Its type species, *T. catena*, is identical with *R. arcuatum* Kütz., and so recognized by Kützing; while Kützing's type species, *R. minutum*, is recognized by him to be *T. catena* Ralfs (not Ehrenb.) and its citation quoted. It is true that Ehrenberg probably included a species of Striatella C. Ag. in his genus Tessella, namely, *T. interrupta*;[c] but he recognizes Striatella C. Ag. as a distinct genus, gives it with diagnosis and figures, and thereby limits by exclusion his own genus Tessella. A reading of his discussion of Striatella[d] will make it evident that his Tessella can not be the same. All of the three species named by Kützing in his new genus Rhabdonema were previously named and figured as species of Tessella and are so recognized by him. He therefore should have emended the genus of Ehrenberg rather than have superseded it with Rhabdonema. He does, it is true, give Tessella as a separate genus, but it fails to correspond to the original and the single species he mentions is a Striatella. Under these circumstances Ehrenberg's name should be restored and simply emended by exclusion of frustules having interrupted septa.

Tessella adriatica (Kütz.) Mann.

Rhabdonema adriaticum Kütz. Bacill 126. *pl. 18. f.* 7. 1844; Sp. Alg. 115. 1849. Pritch. Hist. Infus. ed. 4. 805. *pl. 13. f. 27.* 1861. W. Smith, Synop. Brit. Diat. **2**: 35. *pl. 38. f. 305 b, a′, b′.* 1856. Grun. Verh. Zool. Bot. Ges. Wien **12**: 424. 1862. Jan. & Rabh. in Rabh. Beitr. **1**: 11. *pl. 3. f. 20.* 1863. Rabh. Fl. Eur. Alg. **1**: 306. 1864. O'Meara, Proc. Roy. Irish Acad. II. **2**: 319. 1875. H. L. Smith, Sp. Diat. Typ. no. 432. 1874. Van Heur. Synop. 166. *pl. 54. f. 11–13.* 1881. Truan, Anal. Soc. Espan. Hist. Nat. **14**: 68. *pl. 3. f. 15.* 1885. De Toni, Syll. Alg. **2**: 764 1892. Wolle, Diat. N. A. *pl. 51. f. 2–4.* 1890. Schmidt, Atlas *pl. 217. f. 17–29.* 1895; *pl. 221. f. 14.* 1896.

Tessella sp.? Lobarz. Linnaea **14**: 270. *pl. 4. f. 2.* 1840, according to Kützing and De Toni.

Found at stations 2835, 3698H, 3712H, off Lower California and in Okhotsk Sea.

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[a] Phys. Abh. Akad. Wiss. Berl. **1847**: 448. *pl. 2. III. f. 22.* 1849; probably a species of Fragillaria; op. cit. **1870**: 72. *pl. 1. I. f. 43 a–d.* 1871; probably a Navicula.

[b] Phys. Abh. Akad. Wiss. Berl. **1835**: 173. 1837.

[c] Ehrenb. Infus. 202. 1838.

[d] Op. cit. 229–230.

Tessella catena Ehrenb. Infus. 202. *pl. 20. f.* 7. 1838, not Ralfs, Ann. Mag. Nat. Hist. **12:** 104. *pl. 2. f. 1.* 1843.

Diatoma arcuatum Lyng. Hydro. Dan. 180. *pl. 62.* 1819?

Striatella arcuata C. Ag. Consp. 16. 1832. Ralfs, Ann. Mag. Nat. Hist. **11:** 455. *pl. 9. f. 6.* 1843? not *S. arcuata* Ehrenb. Infus. 230. *pl. 20. f. 6.* 1838.

Rhabdonema arcuatum Kütz. Bacill. 126. *pl. 18. f. 6.* 1844. W. Smith, Synop. Brit. Diat. **2:** 34. *pl. 38. f. 305* (not *f. 305a′–b′.* 1853). Cleve, Bih. Sv. Vet. Akad. Handl. 1^{13}: 24. *pl. 4. f. 21.* 1873. Pritch. Hist. Infus. ed. 4. 804. *pl. 10. f. 203–204.* 1861. H. L. Smith, Sp. Diat. Typ. no. 433. 1874. Cleve & Möll. type no. 69. Schmidt, Atlas *pl. 220. f. 17–26.* Grun. Verh. Zool. Bot. Ges. Wien **12:** 423. 1862. Van Heur. Synop. *pl. 54. f. 14–16.* 1881; Treat. Diat. 360. *f. 111. pl. 12. f. 487a.* 1896. O'Meara, Proc. Roy. Irish Acad. II. **2:** 318, not *pl. 29. f. 5.* 1875. Rabh. Fl. Eur. Alg. **1:** 306. 1864. De Toni, Syll. Alg. **2:** 761. 1892.

Striatella crozierii Ehrenb. Mikrog. *pl. 35A. XXIII. f. 14–16.* 1854.

Rhabdonema crozierii Grun. Verh. Zool. Bot. Ges. Wien **12:** 423. 1862, not *R. crozierii* Ralfs in Pritch. Hist. Infus. ed. 4. 805. *pl. 4. f. 43.* 1861, nor H. L. Smith, Sp. Diat. Typ. no. 434. 1874, nor Schmidt, Atlas *pl. 220. f. 3–11.* 1899; *pl. 221. f. 1–1a.* 1900.

As will be seen by the above synonymy, there is great confusion among the names assigned to this diatom. As Cleve points out,[a] there is no important difference between *R. arcuatum* Kütz. and Grunow's *R. crozierii*, based on *S. crozierii* Ehrenb., the simple difference of outline being of no account. But the *R. crozierii* of Ralfs is an altogether different thing. It corresponds in its dilated center with the variety of *arcuatum* which Cleve calls variety *ventricosum*;[b] but in all other respects it is unlike it. Probably, as Cleve states, it is reproduced by Janisch[c] and called *R. arcuatum.* Whereas *R. arcuatum* Kütz. and *R. crozierii* (Ehrenb.) Grun. has moniliform striae or striae so nearly divided as to appear like a string of beads, the diatom shown by Ralfs, H. L. Smith, and Schmidt has transverse costae bearing fine punctate dots in a single median line, and whereas the zonal divisions of the former are strongly beaded, those of the latter are finely dotted with one or two rows of puncta. Habirshaw[d] masses all these forms together, with the result that he makes this species and *Tessella arcuata* Ehrenb. (=*Striatella*, probably *S. unipunctata*) synonymous, an evident absurdity.

I think *Diatoma arcuatum* Lyngb., and *Striatella arcuata* C. Ag., are not the same diatom; a question not relevant here, as neither can be safely identified with this species. My specimens are uniformly of the outline of Cleve's variety *ventricosum,* but with coarse beading on the valves and heavy markings of the zonal septa, as figured by Schmidt.[e]

Found at stations 3607, 3688H, 3712H, Bering and Okhotsk seas.

Tessella japonica (Temp. & Br.) Mann.

Rhabdonema japonicum Temp. & Br. Mem. Soc. Phys. et Hist. Nat. Geneva **30^{6}:** 53. *pl. 1. f. 6.* 1889. De Toni, Syll. Alg. **2:** 762. 1892. Schmidt, Atlas *pl. 218. f. 7–31, pl. 219. f. 1–4, 6–12.* 1899; *pl. 221. f. 24.* 1900.

Rhabdonema mikado Pant. Beitr. Bacill. Ung. **3:** *pl. 33. f. 469–470.* 1893. Schmidt, Atlas *pl. 219. f. 2–4* (note). 1899.

I have examined a large number of specimens, compared with care all literature, together with figures, to get a clear-cut and satisfactory basis for distinguishing between this and *R. robustum* Grun., but have not succeeded. So far as the valval view is concerned, neither the median line, the arrangement and punctation of the striae, the outline, the size, the character of the border, or the shape of the apical hyaline areas give any constant marks of distinction. So far as I am aware, *robustum* never displays the striking double-lobed valves commonly met with in *japonicum;* but unfortunately this feature is not at all constant in the latter, and in fact the original type is not of that shape.[a] The only appreciable difference is to be found in the zonal view. The striae in *japonicum* are generally small and narrow, forming a closely set row for each compartment of the series, made up of coarse but obscure blotches, giving a semimoniliform appearance to the striae; or if the striae be broad and the blotches approach squares, they are also coarsely dotted. *Robustum* has generally large square markings, set loosely in the rows of each compartment, and marked with fine puncta. I am convinced that these two species are with difficulty to be kept separate; and that a study of the abundant figures in Schmidt[b] will prove this. I have named my specimens solely on the basis of the zonal markings, and many valves unquestionably belonging to a single species, but not affording a zonal view, could with equal accuracy be given Grunow's specific name.

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[a] Bih. Sv. Vet. Akad. Handl. 1^{13}: 24. 1873.

[b] Op. cit. *pl. 4. f. 12.*

[c] Rabh. Beitr. **1:** 12. *pl. 3. f. 19.* 1863.

[d] Hab. Cat. 301. 1877.

[e] Schmidt, Atlas *pl. 220. f. 21–22a.* 1899.

The variety called by Pantocsek *R. mikado* occurs at station 3688H.

Found at stations 2844, 2848, 3604, 3688H, 3784, Bering and Okhotsk seas.

ENTOPYLA Ehrenb.

Entopyla Ehrenb. Ber. Akad. Wiss. Berl. **1848:** 6. 1849. Grun. Verh. Zool. Bot. Ges. Wien **12:** 428. 1862. Schmidt, Atlas *pl. 231.* 1902. De Toni, Syll. Alg. **2:** 773. 1892. Pritch. Hist. Infus. ed. 4. 810. 1861. Rabh. Fl. Eur. Alg. **1:** 308. 1864.

Eupleuria Arn. Quart. Journ. Micr. Sci. **6:** 89. 1858. Pritch. Hist. Infus. ed. 4. 809. 1861.

Margaritoxicon Jan. Abh. Schl. Ges. **1862**^{2}: 6. 1862, as synonym.

Gephyria Arn. in part; Quart. Journ. Micr. Sci. **8:** 20. 1860. Pritch. Hist. Infus. ed. 4. 809. *pl. 4. f. 50.* 1861.

Achnanthes Bory, in part; Johnst. Quart. Journ. Micr. Sci. **8:** 15. *pl. 1. f. 14.* 1860.

Surirella Turp. in part; Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 388. *pl. 1. I. f. 96.* 1843.

The distinctive marks separating this genus from Gephyria Arn. are summarized by Schmidt,[c] as follows: (1) The costae on the valves of Entopyla alternate on either side the median line; in Gephyria they are transversely continuous. (2) The internal septa in Entopyla have their pores in a longitudinal straight row along either side and therefore show as straight rows of dots through the costae; in Gephyria these pores are in two zigzag longitudinal series. (3) These pores are in Entopyla close to the margin on either side; in Gephyria midway between the margin and the median line. Although the foregoing characteristics are well marked and seem to be constant, they constitute at best a scanty basis for generic distinction between forms otherwise so much alike.

Entopyla australis Ehrenb. Ber. Akad. Wiss. Berl. **1848:** 6. 1849. Pritch. Hist. Infus. ed. 4. 810. 1861. Jan. Abh. Schles. Ges. Vaterl. Cult. **1862**^{2}: 6, 22, 32. *pl. 1B. f. 8, 14, 16–20.* 1862. De Toni, Syll. Alg. **2:** 773. 1892. Schmidt, Atlas *pl. 230. f. 1–16.* 1902.

Surirella australis Ehrenb. Phys. Abh. Akad. Wien **1841:** 388. *pl. 1. I. f. 9b.* 1843. Pritch. Hist. Infus. ed. 4. 798. 1861.

Eupleuria incurvata Arnott, Quart. Journ. Micr. Sci. **6:** 90. 1858.

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[a] Cf. Schmidt, Atlas *pl. 219. f. 13.* with *pl. 220. f. 1.* 1899.

[b] Op. cit. *pl. 217–221.*

[c] Op. cit. *pl. 231.* 1902.

Gephyria incurvata Arnott, Quart. Journ. Micr. Sci. **8:** 20. 1860. Pritch. Hist. Infus. ed. 4. 809. *pl. 4. f. 50.* 1861. H. L. Smith, Sp. Diat. Typ. no. 173. 1874. Grun. in Fenzl, Reise Novara Bot. **1:** 8. 1870.

Achnanthes costatus Johnst. Quart. Journ. Micr. Sci. **8:** 15. *pl. 1. f. 14.* 1860. Moeb. Diat.-taf. *pl. 27. f. 14.* 1890.

Entopyla incurvata Grun. Verh. Zool. Bot. Ges. Wien **12:** 428. 1862. De Toni, Syll. Alg. **2:** 773. 1892.

Entopyla cohnii Grun. Verh. Zool. Bot. Ges. Wien **12:** 429. 1862. Grun. in Fenzl. Reise Novara Bot. **1:** 8. 1870.

Margaritoxicon cohnii Jan. Abh. Schl. Ges. Vaterl. Cult. **1862²:** 6. 1862, as synonym.

Gephyria gigantea Grev. Trans. Micr. Soc. Lond. n. s. **14:** 122. *pl. 11. f. 7–8.* 1866. Moeb. Diat.-taf. *pl. 74. f. 7–8.* 1890. Castr. Rep. Voy. Chall. Bot. **2:** 42. *pl. 15. f. 10.* 1886. Wolle, Diat. N. A. *pl. 61. f. 1–2.* 1890. De Toni, Syll. Alg. **2:** 775. 1892.

Gephyria constricta Grev. Trans. Micr. Soc. Lond. n. s. **14:** 77. *pl. 8. f. 2.* 1866. Moeb. Diat.-taf. *pl. 72. f. 2.* De Toni, Syll. Alg. **2:** 775. 1892. Wolle, Diat. N. A. *pl. 61. f. 3.* 1890.

Entopyla hungarica Pant. Beitr. Bacill. Ung. **2:** 67. *pl. 4. f. 58.* 1889.

There is a possibility of questioning the last synonym, as the diagnosis is not thorough and the figure is plainly very carelessly drawn. I do not think the doubt is strong enough to warrant this form receiving separate rank.

Found at stations 3607, 4029H, Bering Sea.

GEPHYRIA Arnott.

Gephyria Arnott, Quart. Journ. Micr. Sci. **8:** 20. 1860. Char. emend. Schmidt. Atlas *pl. 231.* 1902. Rabh. Fl. Eur. Alg. **1:** p. 308. 1864. Grun. Verh. Zool. Bot. Ges. Wien **12:** 429. 1862. De Toni, Syll. Alg. **2:** 775. 1892. Pritch. Hist. Infus. ed. 4. 809. 1861. H. L. Smith. Sp. Diat. Typ. no. 662. 1874. Griff. & Henf. Micr. Dict. ed. 3. 340. 1875. Van Heur. Treat. Diat. 340. *f. 98.* 1896. Truan & Witt, Diat. Hayti 16. *pl. 4. f. 14–17.* 1880.

Eupleuria Arn. in part; Möll. type no. 21.

Achnanthes Bory in part; Johnst. Quart. Journ. Micr. Sci. **8:** 14. *pl. 1. f. 13a, b, f.* 1860.

Entopyla Ehrenb. in part; Grev. Trans. Micr. Soc. Lond. n. s. **14:** 122. *pl. 11. f. 7–8.* 1866.

For the marks of distinction between this and the close genus, Entopyla Ehrenb., see under the latter.

Gephyria media Arnott, Quart. Journ. Micr. Sci. **8:** 20. 1860. Pritch. Hist. Infus. ed. 4. 809. *pl. 4. f. 49.* 1861. Grun. Verh. Zool. Bot. Ges. Wien **12:** 429. 1862. Truan & Witt, Diat. Hayti 16. *pl. 4. f. 14–17.* 1880. Le Diatomiste **2:** *pl. 19. f. 8.* 1894. H. L. Smith, Sp. Diat. Typ. no. 662. 1874. De Toni, Syll. Alg. **2:** 775. 1892. Van Heur. Treat. Diat. 340. *f.* 98. 1896. Wolle, Diat. N. A. *pl. 61. f. 4–5.* 1890. Schmidt, Atlas *pl.* 231. *f. 18–21*, *pl. 232. f. 1–22.*

Eupleuria media Möll. type no. 21.

Achnantes angustata Johnst. Quart. Journ. Micr. Sci. **8:** 14. *pl. 1. f. 13a, b, f.* 1860.

Though Johnston's specific name precedes that of Arnott, it had been preempted by Greville for an entirely different diatom.[a] The genus Gephyria, not having been constituted, Johnston rightly placed his species in Achnanthes; for it should be noted the two genera are, together with Entopyla, quite similar in structure and in mode of growth. The specimen found by me is the short and robust variety called *forma miocena*.[b]

Found at stations 2920H, 3698, Hawaiian Islands and off Honshu Island, Japan.

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[a] Quart. Journ. Micr. Sci. **7:** 163. *pl. 8. f. 9.* 1859.

[b] Le Diatomiste, **2:** *pl. 19, f. 8.* 1894.

CLIMACOSPHENIA Ehrenb.

Climacosphenia Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 314, 440. *pl. 2. VI. f. 1.* 1843. Grun. Verh. Zool. Bot. Ges. Wien **12**: 353. 1862; in Fenzl, Reise Novara Bot. **1**: 5. 1870. De Toni, Syll. Alg. **2**: 739. 1892.

Echinella Achar. err. det. Ehrenb. Ber. Akad. Wiss. Berl. **1841**: 144. 1842.

Clavicula Pant. in part; Beitr. Bacill. Ung. **3**: *pl. 3. f. 50.* 1893.

Climacosphenia elongata Bail. Smithson. Contr. Knowl. **7**: 8. *pl. 1. f. 10–11.* 1854. Grun. Verh. Zool. Bot. Ges. Wien **12**: 353. *pl. 6. f. 22.* 1862. Grun. in Fenzl, Reise Novara Bot. **1**: 5. 1870. Leud.-Fort. Mem. Soc. Emul. St. Brieuc 54. 1879. Pritch. Hist. Infus. ed. 4. 772. 1861. De Toni, Syll. Alg. **2**: 739. 1892.

Climacosphenia frauenfeldii Grun. Verh. Zool. Bot. Ges. Wien **12**: 353. 1862, as synonym.

Clavicula kinkerii Pant. Beitr. Bacill. Ung. **3**: *pl. 3. f. 50.* 1893.

Pantocsek figures the lower portion only of the outer plate of this diatom and names it *Clavicula kinkerii*. There can be no doubt of its being the above. It so happens that the form found by me has precisely the irregularity of beading of the central band near the lower extremity that Pantocsek has figured. Whether this is general or not, I do not know. I have, like Grunow, found it to be a very rare diatom. Leud.-Fort. in the citation above erroneously attributes the name to Grunow.

Found at station 3696, off Honshu Island, Japan.

Climacosphenia moniligera Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 314. *pl. 2. VI f. 1.* 1843. Kütz. Bacill. 123. *pl. 29. f. 80.* 1844. Jan. & Rabh. in Rabh. Beitr. 6. *pl. 2. f. 1.* 1863. Pritch. Hist. Infus. ed. 4. 772. *pl. 11. f. 45–46.* 1861. Grun. Verh. Zool. Bot. Ges. Wien **13**: 139. *pl. 14. f. 17.* 1863. Griff. & Henf. Micr. Dict. ed. 3. *pl. 19. f. 9.* 1875. Wolle, Diat. N. A. *pl. 29. f. 7–8.* 1890. Pant. Beitr. Bacill. Ung. **2**: 67. *pl. 30. f.* 426. 1889. H. L. Smith, Sp. Diat. Typ. no. 631. 1874. De Toni, Syll. Alg. **2**: 740. 1892.

Echinella moniligera Ehrenb. Ber. Akad. Wiss. Berl. **1841**: 144. 1842, nom. nud. not Achar. 1810.

Climacosphenia catena Shadb. Trans. Micr. Soc. Lond. n. s. **2**: *17. pl. 1. f. 15.* 1854. Moeb. Diat.-taf. *pl. 3. f. 15.* 1890.

The generic name Echinella of Acharius [a] was applied by Ehrenberg under a misapprehension, the name being that of a clustered form of marine ovae similar in appearance to clusters of Climacosphenia.[b] Ehrenberg corrected the generic name in the first citation given above.

Found at station 2920H, Hawaiian Islands.

PLAGIOGRAMMA Grev.

Plagiogramma Grev. Quart. Journ. Micr. Sci. **7**: 208. *pl. 10.* 1859. Moeb. Diat.-taf. *pl. 24.* 1890. Rabh. Fl. Eur. Alg. **1**: 117. 1864. Pritch. Hist. Infus. ed. 4. 773. 1861. Van Heur. Synop. 145. 1881; Treat. Diat. 337. *f. 95.* 1896. De Toni, Syll. Alg. **2**: 717. 1892.

Denticula Kütz. in part; Greg. Trans. Roy. Soc. Edinb. **21**: 494, 496. *pl. 10. f. 32, 37a–c.* 1857.

This genus has close affinity with Dimeregramma Ralfs, and the doubtful genus Glyphodesmis Grev. It is, however, well marked from these by the internal transverse septa, especially those that divide off the central and the terminal hyaline areas from the rest of the valve. I am not in favor of including here any of the members of Ehrenberg's genus Heteromphala. Its type, *H. himantidium*,[a] is probably a Glyphodesmis, certainly not a Plagiogramma. De Toni,[b] quotes it in its original genus. Ralfs[c] changes it to *Plagiogramma himantidium*. As he there says, the side view is unknown. How he could decide on its being a Plagiogramma from Ehrenberg's description and without any knowledge of its side view is beyond my comprehension. There are two references in Ehrenberg which De Toni thinks it worth while to quote as members of this genus, one[d] called with some doubt "*Heteromphala? trinodis*," a probable Navicula, and the other *H. binodis*,[e] which is either a Navicula or a Glyphodesmis. Figure 22 of the same plate, called by Ehrenberg simply "Anaulus—?," is, despite the central and terminal nodules, almost certainly a representative of this genus, probably *P. elongatum* Grev., a fact which also indicates that what he calls Heteromphala is not identical with the present genus.

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[a] Weber, Beitr. z. Naturk. **2**: 340. *pl. 4.* 1810.

[b] Griff. & Henf. Micr. Dict. ed. 3. 273. 1875.

Plagiogramma elongatum Grev. Trans. Micr. Soc. Lond. n. s. **14**: 121. *pl. 11. f. 1–2*. 1866. Moeb. Diat.-taf. *pl. 74. f. 1–2*. 1890. De Toni, Syll. Alg. **2**: 720. 1892.

Anaulus sp.? Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1872**: 387. *pl. 2. f. 22*. 1873.

This species is like *P. crassum* Cleve & Grove,[f] except for the massive transverse septa of the latter.

Found at station 2807, Galapagos Islands.

Plagiogramma sceptrum Mann, sp. nov. PLATE LII, FIGURES 1, 2.

Valve elongated; sides nearly parallel to the broad rounded apices; markings of small but strong beading, set in transverse rows, interrupted by a median hyaline line, two beads wide, running nearly the entire length of the valve, that is, from one apical area to the other; four to five beads in each half row on either side of the median line; apical areas, in this genus usually hyaline or faintly mottled, here beaded with slightly smaller beads, spread out fan-wise toward the sides and apices of the valve and traversed by a thin irregular median line continuous with the median line of the rest of the valve; border not plain, but ornamented with a single row of beads larger than the rest. Instead of transverse "vittae" there are strong internal transverse septa, not continuous across the valve, but usually stopping at the position of the hyaline median line before mentioned and generally not opposite each other on the two sides of the valve; central area quite small, not reaching the border, transversely oval and bearing a decided boss in the middle; zonal view showing the internal septa enlarged at the inner ends like the music-notes of *Terpsinoe musica* Ehrenb.; the septa as seen both in zonal and valval view, placed at very irregular distances, there being from two to seven rows of beads between them; girdle with two faint longitudinal ridges dividing it into thirds, but no beading.

Length of valve, 0.200 to 0.212mm.; width of valve, 0.027 to 0.029mm.

The only species at all like this one is *P. rectum* Cleve & Grove. The resemblance is merely superficial.

Type in the U. S. National Museum, No. 590141, from station 2807, Galapagos Islands, April 4, 1888; 812 fathoms, bottom of Globigerina ooze and coral mud.

Plagiogramma tesselatum Grev. Quart. Journ. Micr. Sci. **7**: 208. *pl. 10. f.* 7. 1859. Moeb. Diat.-taf. *pl. 24. f.* 7. 1890. Pritch. Hist. Infus. ed. 4. 774. 1861. Lewis, Proc. Acad. Phila. **1861**: 68. 1862. De Toni, Syll. Alg. **2**: 719. 1892. Grun. Verh. Zool. Bot. Ges. Wien **12**: 359. 1862.

The absence of internal transverse septa in this species led Greville to have some doubt of its right here. Grunow thought it might be made a new genus. Except for this lack it is a perfectly typical Plagiogramma, and this negative quality is insufficient for separating it. Specimens found in the following dredging have a circular central area and nearly round instead of rectangular or "tesselated" beading.

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[a] Ber. Akad. Wiss. Berl. **1858**: 13. 1859.

[b] De Toni, Syll. Alg. **2**: 730. 1892.

[c] Pritch. Hist. Infus. ed. 4. 775. 1861.

[d] Ber. Akad. Wiss. Berl. **1861**: 295. 1862,

[e] Phys. Abh. Akad. Wiss. Berl. **1872**: *pl. 2. 6. 23. 1873.*

[f] Le Diatomiste **1**: 54. *pl. 8. f. 4–5*. 1891.

Found at station 2808, Galapagos Islands.

DIMEREGRAMMA Ralfs.

Dimeregramma Ralfs in Pritch. Hist. Infus. ed. 4. 790. *pl. 4. f. 33–35.* 1861. Rabh. Fl. Eur. Alg. **1:** 13. 123. *f. 36.* 1864. Van Heur. Synop. 146. *pl. 36. f. 7–13.* 1881–1885. De Toni, Syll. Alg. **2:** 711. 1892. Walk. & Chase, Notes on Diat. **1:** 1. *pl. 1. f. 3.* 1886. Grun. Verh. Zool. Bot. Ges. Wien **12:** 377. 1862. Pritch. Hist. Infus. ed. 4. 790. *pl. 4. f. 34.* 1861.

Denticula Kütz. in part; Greg. Trans. Roy. Soc. Edinb. **21:** 495. *pl. 10. f. 39.* 1857.

The nearest genus to this is Glyphodesmis Grev., from which it differs by the absence of a large central boss. This single characteristic is, however, striking and uniform. Castracane[a] is wrong in stating that the only distinction between this genus and Denticula Kütz. is that the former has smooth sides to the valves. Dimeregramma may have the same; but it has a pronounced hyaline median line, "pseudoraphe," dilated at the center, is without transverse costae, and has large boss-like elevations at the apices (seen clearly in the zonal view), all which distinctions are inapplicable to Denticula.

Dimeregramma inflatum Mann, sp. nov. PLATE XLIV, FIGURE 6.

Valve seven to eight times as long as broad, inflated at the center, with bluntly tapering ends; at the apex of each a large beak-like process; valves marked with transverse rows of beading, extending from the margin for one-third the width of the valve, leaving a median hyaline area, also one-third the width of the valve; each row consisting of four beads, the outer largest and decreasing in size toward the center.

Length of valve 0.086 mm; width of valve 0.015 mm.

Type in the U. S. National Museum, No. 590142, from station 2823, Gulf of California, April 30, 1888; 26.5 fathoms, bottom of broken shells.

The nearest form to this is *D. marinum* (Greg.) Ralfs,[b] but I have found it impossible to refer it to that species. Gregory's form has striae with two beads somewhat separated, their line being continued outward to the margin by bars or costae; whereas the moniliform lines in my species begin with very large marginal beads and end inward with beads of extreme minuteness. Indeed the whole build of the diatom is distinct.

ACHNANTHES Bory.

Achnanthes Bory, Dic. Hist. Nat. **1:** 79. *pl. 51. f. 2.* 1822.

Monogramma Ehrenb. Ber. Akad. Wiss. Berl. **1843:** 136. 1844, no species, 1854, not Comm. 1809.

Achnanthidium Kütz. Bacill. 75. 1844.

Achnanthes dispar Mann, sp. nov. PLATE XLIV, FIGURES 4, 5.

Under valve beaded with minute moniliform striae, transverse until near the ends, then becoming concentric to the points of the apices; the raphe made up of a closely set but moniliform line of exceedingly small beads, at least toward its central and terminal portions, and forking near each end into two branches, one proceeding to the rounded apex and terminating in a small bead, the other and shorter branch running to one side and also terminating in a small bead; a narrow hyaline area on either side of the raphe; the transverse, median, hyaline stauros broad and increasing at the margins; upper valve with a broad, central, longitudinal, hyaline area, slightly wider near the center of the valve; striae of coarse and distant beads, two to four on each side of the median line, transverse until near the ends, then becoming concentric to the points of the apices.

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[a] Castr. Rep. Voy. Chall. Bot. **2:** 46. 1886.

[b] Trans. Roy. Soc. Edinb. **21:** 496. *pl. 10. f. 39.* 1857. Pritch. Hist. Infus. ed. 4. 90 1861. Van Heur. Synop. *pl. 36. f. 9.* 1881. De Toni, Syll. Alg. **2:** 712. 1892.

Length of valve, 0.08 mm.; width of valve, 0.018 mm. Rows of beading on under valve, 88 in 0.1 mm.; on upper valve, 56 in 0.1 mm.

Type in the U. S. National Museum, No. 590143, from station 3635H, Bering Sea, August 21, 1895; 141 fathoms, bottom of gray sand.

The nearest approach to the above is *Achnanthidium* (=*Achnanthes*) *arcticum*, Cleve,[a] but the differences are greater than the resemblance. The beading on the under (ventral) side of Cleve's species is 68 in 0.1 mm. with a valval length of 0.048 mm., whereas in mine it is 88 in 0.1 mm. with a valval length of 0.08 mm.; in other words, it is very much finer on a valve about twice as large, as the proportion between size of valve and striation in Cleve's species would be in my specimen 41 instead of 88 in 0.1 mm. But what shows that this is not a very finely marked though large specimen of the above is that the valves do not taper, but have blunt, rounded ends; the markings are strictly transverse except toward the apices; the stauros is quite broad; the raphe is beaded and bifurcates near the ends; there is a broad, hyaline line on either side of the raphe; a distinctly marked rim of uniform breadth runs around the entire valve.

COCCONEIS Ehrenb.

Cocconeis Ehrenb. Infus. 193. *pl. 14. f. 8-9, pl. 21. f. 11.* 1838.

Campyloneis Grun. Verh. Zool. Bot. Ges. Wien **12:** 429. 1862. Fenzl, Reise Novara Bot. **1:** 10. 1870.

Orthoneis Grun. in part, in Fenzl, Reise Novara Bot. **1:** 9-10. 1870.

Anorthoneis Grun. in Fenzl, Reise Novara Bot. **1:** 9-10. 1870.

Grunow breaks up Ehrenberg's genus by emending its scope and creating the above three new genera. I do not find any advantage in this arrangement. Ehrenberg's generic concept is a well-marked and precise one; its members are in clear contrast with other diatoms by their solitary growth attached by the inferior, raphe-bearing valve, by the concavo-convex shape of the frustules, by the general, perhaps universal, dissimilarity of the inferior and superior valves, and by their uniform oval or suboval contour. However useful Grunow's distinctions may be for subgeneric division, it seems to me best to leave these forms in the compact and satisfactory genus that Ehrenberg constructed for them. This view seems to prevail with most authors.

Cocconeisa antiqua Temp. & Brun. Mem. Soc. Phys. et Hist. Nat. Geneva **30^9:** 32. *pl. 8. f. 5.* 1889. Schmidt, Atlas *pl. 191. f. 50, 52.* 1877.

Cocconeis trachytica Pant. Beitr. Bacill. Ung. **3:** *pl. 42. f. 582.* 1893.

The form from station 3604H is identical with Schmidt's figures above. It is, however, wide of the type, and I assign this name to it with some doubt. More typical specimens occur at station 4029H, together with a variety which lacks the curved hyaline bands midway between the raphe and the sides.

Found at stations 3604H, 4029H, Bering Sea.

Cocconeis baldjikiana Grun.; Van Heur. type no. 546. Schmidt, Atlas *pl. 190. f. 7-10.* 1894.

Cocconeis scutellum Ehrenb.; Grun. Bot. Centralblatt **33:** 324. 1888. Cleve in Schmidt, Atlas *pl. 190. f. 7-10.* 1877.

I agree with Schmidt in the above citation that Grunow's union of this beautiful and vigorous form with *C. scutellum* Ehrenb. is inadvisable. Even Smith's too strongly marked figure[b] of the latter lacks the beautiful broadening of the markings of this species, as well as their breaking up into fine puncta near their union with the margin.

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[a] Bih. Sv. Vet. Akad. Handl. 1^{13}: 25. *pl. 4. f. 22.* 1873.

[b] W. Smith, Synop. Brit. Diat. **2:** *pl. 3. f. 34.* 1856.

Found at station 2848, south of Alaska Peninsula.

Cocconeis costata Greg. Quart. Journ. Micr. Sci. **3**: 39. *pl. 4. f. 10.* 1855. Trans. Micr. Soc. Lond. n. s. **5**: 68. *pl. 1. f. 27.* 1857. Moeb. Diat.-taf. *pl. 5. f. 10*; *pl. 12. f. 27.* 1890. Rabh. Fl. Eur. Alg. **1**: 104. 1864. Jan. Abh. Schles. Ges. Vaterl. Cult. **1862**²: 18. *pl. 1A. f. 36.* 1862. Cleve in Nordensk. Vega Exped. **3**: 460. 1883. Van Heur. Synop. *pl. 30. f. 11–17.* 1881. Pritch. Hist. Infus. ed. 4. 871. 1861. Cleve, Sv. Vet. Akad. Handl. **27**³: 182. 1895.

Surirella quarnerensis Grun. Verh. Zool. Bot. Ges. Wien **12**: 456. *pl. 9. f. 10.* 1862.

Raphoneis scutelloides Grun. Verh. Zool. Bot. Ges. Wien **12**: 383. *pl. 4. f. 34.* 1862.

Raphoneis archeri O'Meara, Quart. Journ. Micr. Sci. n. s. **7**: 247. *pl. 7. f. 12.* 1867. Moeb. Diat.-taf. *pl. 77. f. 12.* 1890.

Cocconeis imperatrix Schmidt, Atlas *pl. 189. f. 10–15.* 1894.

Cocconeis janischii Schmidt, Atlas *pl. 189. f. 33.* 1894.

Cocconeis extravagans Jan.; Schmidt, Atlas *pl. 189. f. 28–32.* 1894.

Campyloneis costata Lagers. Bih. Sv. Vet. Akad. Handl. **3**¹⁵: 55. 1876. De Toni, Syll. Alg. **2**: 441. 1891.

Campyloneis grevillei Grun. in Fenzl, Reise Novara Bot. **1**: 11. 1870, not *Cocconeis grevillei* W. Smith.

There is not enough similarity between this species and *C. regina* Johns.[a] or between this and the gigantic *C. kerguelensis* Pet.[b] to warrant uniting them, as is done by Cleve.[c] The species is, however, a very variable one both in size and markings.

Found at station 3604, Bering Sea.

Cocconeis decipiens Cleve, Bih. Sv. Vet. Akad. Handl. **1**¹³: 14. *pl. 1. f. 6.* 1873; Nordensk. Vega Exped. **3**: 460. 1883. Cleve & Grun. Sv. Vet. Akad. Handl. **17**²: 16. 1880. De Toni, Syll. Alg. **2**: 450. 1891.

Cocconeis arctica Cleve, Bih. Sv. Vet. Akad. Handl. **1**¹³: 14. *pl. 2. f. 11a* (not *f. 11b*). 1873. Cleve & Grun. Sv. Vet. Akad. Handl. **17**²: 16. 1880.

Cocconeis sigmoradians Temp. & Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **30**⁹: 33. *pl. 8. f. 4.* 1889.

Cocconeis sigma Pant. Beitr. Bacill. Ung. **1**: 32. *pl. 8. f. 68.* 1886. Schmidt, Atlas *pl. 196. f. 11.* 1894. Temp. & Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **30**⁹: 70. 1889.

Cocconeis oculus-catis Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **31**¹: 17. *pl. 18. f. 5.* 1891.

Cocconeis sparsipunctata Brun, Mem. Soc. Phys. et Hist. Nat. Geneva 31¹: 18. *pl. 18. f. 8.* Schmidt, Atlas *pl. 196. f. 12–15.* 1894.

Cocconeis dirupta Greg. var.; Van Heur. Synop. *pl. 29. f. 18–19.* 1881. Cleve; Schmidt, Atlas *pl. 196. f. 16.* 1894.

Cocconeis fulgur Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **31**¹: 17. *pl. 18. f. 3.* 1891.

A discussion of the separation of this species from *C. dirupta* Greg., with which it is united by Cleve, may be found under the latter species. It may be here stated that the union of the above sigmoid forms agrees with De Toni[d] in so far as that he does not admit them under *C. dirupta*, but either gives them separate rank or unites one or two, as *C. decipiens* Cleve and *C. arctica* Cleve.

Most of the above are found in the following dredgings; that corresponding to

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[a] Quart. Journ. Micr. Sci. **8**: 13. *pl. 1. f. 12.* 1860.

[b] Miss. Sci. Cap. Horn 116. *pl. 10. f. 5.* 1889.

[c] Bih. Sv. Vet. Akad. Handl. **27**³: 182. 1895.

[d] Syll. Alg. **2**: 450. 1891.

C. arctica at station 3607, itself an arctic dredging, is another illustration of the value of the diatoms for fixing the source of the material composing sea bottoms.

Found at stations 3607, 4516H, Bering Sea and off Lower California.

Cocconeis dirupta Greg. Trans. Roy. Soc. Edinb. **21:** 491. *pl. 1. f. 25.* 1857. Jan. Abh. Schles. Ges. Vaterls. Cult. **1862**^{2}: 3. *pl. 2B. f. 14.* 1862. Grun. in Fenzl, Reise Novara Bot. **1:** 14. 1870. Cleve in Nordensk. Vega Exped. **3:** 460. 1883. H. L. Smith, Sp. Diat. Typ. no. 633. 1874. Van Heur. Synop. *pl. 29. f. 13–15.* 1881. Schmidt, Atlas *pl. 196. f. 7, 17, 18.* 1894. De Toni, Syll. Alg. **2:** 453. 1891.

Cocconeis diaphana W. Smith, Synop. Brit. Diat. **1:** 22. *pl. 30. f. 254B.* 1853.

Cocconeis beltmeyeri Jan.; Schmidt, Atlas *pl. 196. f. 22–23.* 1894.

Cocconeis delicata Schmidt, Atlas *pl. 196. f. 24.* 1894.

Cleve[a] unites under the above name, in addition to those here given, all cases of his own *C. decipiens*[b] which are similar to the above in the broadly oval character of the valves, in the fineness and curvature of the beading, in the presence of a transverse stauros at the middle of the lower valve, and in a general tendency toward a sigmoid outline in the median line of one or both valves. There is much in favor of this, for *C. dirupta* does show these characters, even the sigmoid curvature in some instances. But such unification is here attended with confusion. The forms thus grouped are too diverse, e. g., *C. beltmeyeri* Jan., a very evident variety of *C. dirupta* and *C. sparsipunctata* Temp. & Brun., a very evident variety of *C. decipiens*. To call these two one species is carrying condensation too far for practical use. I have accordingly united only the three above names with *C. dirupta* and have grouped all the other forms under *C. decipiens*. This arrangement, though no less artificial than that of Cleve, is no more so, and it affords an easy means of grouping these confusing forms. The salient characteristic of *C. dirupta* is, as its name indicates, a hyaline median area on one or both valves, broad at the center and tapering to a point at each end, slightly or not at all sigmoid. This line in *C. decipiens* is slightly or extremely sigmoid, the ends of the raphe curved like an "S" in opposite directions, the median area generally narrow or sometimes wanting, and the transverse stauros plain. It may be added that the members of the *C. dirupta* group are generally much smaller than those belonging to *C. decipiens*.

Found at stations 2690H, 4516H, off central and Lower California.

Cocconeis distans Greg. Quart. Journ. Micr. Sci. **3:** 39. *pl. 4. f. 9.* 1855; **5:** 67. *pl. 1. f. 25.* 1857. Moeb. Diat.-taf. *pl. 5. f. 9, pl. 12. f. 25.* 1890. Schmidt, Atlas *pl. 193. f. 29–37, 40.* 1894; Jahresb. Komm. Deut. Meere **2:** *pl. 3. f. 22–23.* 1874. Pritch. Hist. Infus. ed. 4. 870. *pl. 7. f. 38.* H. L. Smith, Sp. Diat. Typ. no. 70. 1874.

Grunow[c] makes this a variety of *C. scutellum* Ehrenb., for which there is some warrant. As there is, however, quite a difference between what I conceive to be Gregory's type and that of Ehrenberg, I have retained the above name. The two figures of Gregory's in the above citations are not at all alike. The first was evidently incorrectly drawn by Tuffen West, so far as the beading is concerned. It is represented in very regular rows evenly graded from the large marginal beads to the smaller medium ones. But Gregory says,[d] "This beautiful form is at once characterized by the equal size of the dots or granules and their great distance from each other, so that it almost loses the aspect of striation." The faulty representation of this is corrected, in fact over-corrected, in Gregory's second figure. When the type idea of Gregory's species is thus made out and is compared with Ehrenberg's original figure and description,[e] it seems to me the two are sufficiently wide apart to admit of the retention of both names.

Found at station 4505H, Santa Cruz light-house, Monterey Bay, Cal.

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[a] Sv. Vet. Akad. Handl. **27**^{3}: 175. 1895.

[b] Bih. Sv. Vet. Akad. Handl. **1**^{13}: 14. *pl. 1. f. 6.* 1873.

[c] Fenzl, Reise Novara Bot. **1:** 9. 1870.

[d] Op. cit. 39.

[e] Ehrenb. Infus. 194. *pl. 14. f. 8.* 1838.

Cocconeis grevillei W. Smith, Synop. Brit. Diat. **1**: 22. *pl. 3. f. 35.* 1853. Rabh. Fl. Eur. Alg. **1**: 102. 1864. Jan. Abh. Schl. Ges. Vaterl. Cult. **1862**^{2}: 18. *pl. 1. f.* 10. 1862. H. L. Smith, Sp. Diat. Typ. no. 72. 1874. Pritch. Hist. Infus. ed. 4. 870. 1861.

Campyloneis grevillei Grun. err. det. in Fenzl, Reise Novara Bot. **1**: 10, 98. 1870. Journ. Roy. Micr. Soc. **1**: 245. *pl. 14. f. 5.* 1878. Petit, Fonds de la Mer **3**: 171. *pl. 4. f. 5.* 1877. Van Heur. Synop. 134. *pl. 28. f. 8–12.* 1881. De Toni, Syll. Alg. **2**: 439. 1891. Grun. Verh. Zool. Bot. Ges. Wien **12**: 430. 1862.

Campyloneis argus Grun. Verh. Zool. Bot. Ges. Wien **12**: 429. *pl. 10. f. 9.* 1862. Fenzl, Reise Novara Bot. **1**: 10. 1870. Van Heur. Synop. 134. *pl. 28. f. 15–16.* 1881. De Toni, Syll. Alg. **2**: 441. 1891. Truan, Anal. Soc. Espan. Hist. Nat. **13**: 363. *pl. 10. f. 22–23.* 1884.

De Toni[a] gives separate rank to *C. grevillei* W. Smith, *C. regalis* Grev. and *C. argus* Grun. under the generic head Campyloneis. Cleve, in above citation, unites the three under *Campyloneis grevillei* (W. Smith) Grun., thus following Grunow's analysis.[b] I do not think *C. grevillei* and *C. argus* can be held separate. Differences exist, but they are slight and variable, having chiefly to do with the thickenings on the internal craticular plates. But the union of Greville's *C. regalis* with these is too radical. A comparison of the published figures does not show the strong contrast that is to be seen in specimens of these two species. The craticular plates and the inferior valves are never closely alike; but the widest difference is to be seen in the superior plates, which in *C. grevillei* have beading actually or approximately alike in the middle and outer portions, while *C. regalis* has an oval central area marked with bars of fine puncta, while the outer area, separated from this central portion, is marked by very large beads. Two specimens afforded by H. L. Smith, types no. 72 and no. 635, show this contrast finely, the former of *C. grevillei* from Granville, France, and the latter of *C. regalis* from Cape of Good Hope. I therefore take the position of Van Heurck, De Toni, and others in classifying these species separately.

Found at stations 2807, 3698, Galapagos Islands and Honshu Island, Japan.

Cocconeis pellucida Grun. in Rabh. Beitr. **1**: 21. *pl. 6. f. 11.* 1862; in Fenzl, Reise Novara Bot. **1**: 12. 1870, not *C. pellucida* Grun. Verh. Zool. Bot. Ges. Wien **13**: 145. *pl. 13. f. 6.* 1863, which is *C. pseudomarginata* Greg. Schmidt, Atlas *pl. 191. f. 48, pl. 193. f. 5–8, pl. 194. f. 2, 15, pl. 195. f. 1–6.* 1894. Grun. in Fenzl, Reise Novara Bot. **1**: 98. *pl. 1. f. 7–8.* 1870. De Toni, Syll. Alg. **2**: 455. 1891. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 178. 1894. Pant. Beitr. Bacill. Ung. **3**: *pl. 32. f. 465.* 1893.

Cocconeis curvi-rotunda Temp. & Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **30**^{9}: 32. *pl. 8. f. 6.* 1889. Schmidt, Atlas *pl. 195. f. 10–19.* 1894.

Cocconeis lunyacsekii, Pant. Beitr. Bacill. Ung. **3**: *pl. 41. f. 564.* 1893.

Cocconeis notabilis Pant. Beitr. Bacill. Ung. **3**: *pl. 35. f. 492.* 1893.

Cocconeis circumcincta Schmidt, Atlas *pl. 195. f. 7–9.* 1894.

The doubt of Tempere and Brun of their *C. curvi-rotunda* being anything more than a variety of this species, indicated by their bracketing the latter name with their own, is, I think, well founded. Indeed, I have met with all possible varieties of these extremely close forms, and I am convinced they should be united. So also regarding *C. circumcincta* Schmidt. Its radially arranged markings and its generally straight raphe are not sufficient to separate it from the above. It occurs at stations 3346 and 3604. I exclude *C. heteroidea* Hantzsch[c] and the variety of it regarded by Janisch as a species *C. flexella*,[d] though both Grunow and De Toni are impressed with their close affinity. They belong, with *C. emmerici* Jan. and *C. aliena* Schmidt, to a very different group. Grunow explains [a] that he gave the name *pellucida* [b] to a specimen of *C. pseudomarginata* Greg., being misled by a poor figure of Ralfs. [c] He refers to the form cited by Hantzsch [d] as the true type.

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[a] De Toni, Syll. Alg. **2**: 439–441. 1891.

[b] Fenzl, Reise Novara Bot. **1**: 10. 1870.

[c] Rabh. Beitr. **1**: 21. *pl. 6. f. 10.* 1862.

[d] Rabh. Beitr. **1**: 7. *pl. 1. pl. 11.* 1862.

Found at stations 2844, 2848, 3346, 3604, 3604H, Aleutian Islands and Bering Sea.

Cocconeis senegalensis Breb.; H. L. Smith, Sp. Diat. Typ. no. 79. 1874. De Toni, Syll. Alg. **2:** 464. 1891. Hab. Cat. 84. 1877.

Though both De Toni and Habirshaw recognize this as an authentic species, I suspect it is a synonym of some other form. I have been, however, unable to find such, and as my specimen agrees with Smith's type I am compelled to assign this name provisionally.

Found at stations 2680H, 2694H, 4516H, off central and Lower California.

Cocconeis splendida Greg. Trans. Roy. Soc. Edinb. **21:** 493. *pl. 9. f. 29.* 1857. Pritch. Hist. Infus. ed. 4. 870. 1861. Rabh. Fl. Eur. Alg. **1:** 102. 1864.

Orthoneis splendida Grun. in Fenzl, Reise Novara Bot. **1:** 15. 1870. Van Heur. Synop. *pl. 28. f. 1–2.* 1881. Cleve, Sv. Vet. Akad. Handl. **27³:** 148. 1895. Pant. Beitr. Bacill. Ung. **2:** *pl. 24. f. 352.* 1889. Truan & Witt, Diat. Hayti 18. *pl. 4. f. 13.* 1888. Truan, Anal. Soc. Espan. Hist. Nat. **13:** 363. *pl. 10. f. 20.* 1884.

Cocconeis punctatissima Grev. Quart. Journ. Micr. Sci. **5:** 8. *pl. 3. f. 1.* 1857. Moeb. Diat.-taf. *pl. 11. f. 1, 1*.* 1890.

Orthoneis punctatissima Lagerst. Bih. Sv. Vet. Akad. Handl. **3¹⁵:** 57. 1876. De Toni, Syll. Alg. **2:** 466. 1891.

Melosira cribrosa Grun. Verh. Zool. Bot. Ges. Wien **12:** 577. *pl. 5. f. 10a–d.* 1860.

It is not perfectly clear that Greville's and Gregory's species are the same. That of Greville would appear from the figures to be much more finely beaded, particularly as he says its beading is "very minute," especially toward the median line. The fact is also against their identity that Greville made the drawings for Gregory's paper, including this very form, yet does not look upon his own publication as a renaming of the same diatom. But they are united by Cleve, Grunow, De Toni, and others, while Ralfs holds them separate. If admitted to be the same, which seems on the whole to be best, the question what name should be assigned presents some difficulties. Both names were published in 1857. [e] There is no record in the Proceedings of the London Microscopical Society as to when Greville's paper was presented, in the records either of 1856 or of 1857. Gregory's paper was read January 19, 1857, and appeared that year. The preference would, therefore, be in favor of Gregory; and as his name is the better established of the two, I have for all these reasons adopted it.

Grunow's *Melosira cribrosa* must be included here. It appears to me more nearly to resemble the Greville type than that of Gregory, though Grunow and Cleve take an opposite view. It is also rather difficult to see the reasons for assigning only figures 10 a, b of Grunow's figures to this species and placing the other two, figures 10 c and d, in different species, as Grunow does. [f]

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[a] Fenzl, Reise Novara Bot. **1:** 12. 1870.

[b] Verh. Zool. Bot. Ges. Wien **13:** 145. 1863.

[c] Pritch. Hist. Infus. ed. 4. *pl. 7. f. 39.* 1861.

[d] Hantzsch in Rabh. Beitr. **1:** 21. *pl. 6. f. 11.* 1862.

[e] Greville's paper was published on pages 7–12 of the Quart. Journ. Micr. Sci. for 1857, which probably appeared before July, if not as early as April or May, 1857. While Gregory's paper was read on January 19, 1857, it was not published until an appendix dated May 28, 1857, and a corrigenda dated August 1, 1857. It constituted pages 473–542 of Trans. Roy. Soc. Edinb. **21:** 1857, which came at the end of the volume which unquestionably was not published until after August 1, 1857.

[f] Fenzl, Reise Novara Bot. **1:** 16. 1870.

Small specimens of the present species approach closely to robust specimens of *C. adriacica* Kütz., a variety of *C. scutellum* Ehrenb., the best mark of distinction being the round and widely set beads of *C. splendida* and the more compact and rectangular beads of *C. scutellum*.

Found at station 3696, off Honshu Island, Japan.

NAVICULA Bory.

Navicula Bory, Encycl. Meth. d'Hist. Nat. **2:** 562. 1824. Ehrenb. Infus. 173. 1838. Kütz. Bacill. 88. 1844. De Toni, Syll. Alg. **2:** 6. 1891. W. Smith, Synop. Brit. Diat. **1:** 46. 1853. Donk. Brit. Diat. 2. 1871–1873. Van Heur. Synop. 71. 1881; Treat. Diat. 162. 1896. Castr. Rep. Voy. Chall. Bot. **2:** 22. 1886. Pritch. Hist. Infus. ed. 4. 892. 1861. Rabh. Fl. Eur. Alg. **1:** 168. 1864. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 4, 136. 1894; **27**^{3}: 10. 1895. Cleve & Grun. Bih. Sv. Vet. Akad. Handl. **17**^{2}: 27. 1880. Grun. Verh. Zool. Bot. Ges. Wien **10:** 513. 1860. Brun, Diat. Alp. 63. 1880.

Pinnularia Ehrenb. Ber. Akad. Wiss. Berl. **1840:** 213. 1841. W. Smith, Synop. Brit. Diat. **1:** 54. 1853.

Diploneis Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 84. 1845. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 76. 1894.

Stauroptera Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 134. 1843.

Stauroneis Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 134. 1843. Kütz. Bacill. 194. 1844. De Toni, Syll. Alg. **2:** 204. 1891. Van Heur. Treat. Diat. 158. 1896.

Pleurostauron Rabh. in part; Grun. in Fenzl, Reise Novara Bot. **1:** 101. 1870.

Dickieia Berk. in part; Van Heur. Synop. *pl. 16. f. 10.* 1881; Treat. Diat. 233. 1896.

Anomoeoneis Pfitz.; Cleve, Sv. Vet. Akad. Handl. **27**^{3}: 6. 1895.

Neidium Pfitz. in Hanst. Bot. Abhandl. **2:** 39. 1871. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 68. 1894.

Caloneis Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 46. 1894.

Stenoneis Cleve, Sv. Vet. Akad. Handl. **27**^{3}: 123. 1895.

Frustulia C. Ag. in part; Kütz. Linnaea **8:** *pl. 13. f. 16.* 1833.

Cymbella C. Ag. (=*Cocconema* Ehrenb.) in part; Consp. Diat. 8. 1832.

Synedra Ehrenb. in part; Kütz. Bacill. 63. *pl. 3. f. 29.* 1844.

Amphiprora Ehrenb. in part; Mikrog. *pl. 3. I. f. 10–11, III. f. 8a–c.* 1854.

Schizonema C. Ag. in part; W. Smith, Synop. Brit. Diat. **2:** 71. 1856.

Colletonema Breb. in part; W. Smith, Synop. Brit. Diat. **2:** 70. *pl. 56. f. 351–353.* 1856.

Achnanthidium Kütz. in part; W. Smith, Synop. Brit. Diat. **2:** 31. *pl. 61. f. 380.* 1856.

Pleurosigma W. Smith in part; Ehrenb. Infus. 180. *pl. 13. f. 10.* Kütz. Bacill. 102 (no. 127, 128, etc.) *pl. 4. f. 25, 26,* etc.

The enormous size of this genus has incited many authors to attempt its division upon more or less tenable grounds. Thus Ehrenberg divided it into Navicula (Bory) Ehrenb. and Pinnularia Ehrenb., the chief distinction being that the former had smooth, the latter ribbed, valves. But the distinction was seen to be fictitious, and Kützing and Brebisson refused to accept it. William Smith revived the names, making the distinguishing feature the character of the striation, that in Pinnularia being composed of smooth costae, while Navicula had the striae broken more or less into moniliform or beaded lines. This would serve admirably to distinguish such species as *Pinnularia nobilis* Ehrenb. from *Navicula aspera* Ehrenb. But two difficulties have stood in the way of making application of this distinction in general; first, very few of the multitude of species in the genus can be positively classified by this criterion, every conceivable gradation between plain (or apparently plain) costae and rows of independent beads being presented; and, second, in even the extreme Pinnularia type the apparent presence or absence of perfectly smooth bars or costae is largely a matter of illumination. It is true that scientific classifications are chiefly valuable for so assorting objects of nature into small groups as to render easy their availability and identification. Nor can at the present time that other purpose of classification, the indication of relationships, be pressed very strongly. But unless all the usual conceptions of the word "genus" are to be ignored, the distinctions drawn by William Smith must be considered as too unimportant and especially too unstable to admit of adoption.

By far the most painstaking and thorough analysis of Navicula is that of Cleve in his Naviculoid Diatoms.[a] I regret I can not follow his divisions of this genus. It would be aside from the purpose of this report to discuss in ample detail the merits of this extensive work. It must, therefore, suffice to say that a careful reading of the chapter "On the value of the characteristics," on page 4 of that work, will, in connection with the divisions of Navicula subsequently made in the work, reveal the fact that nearly all the characteristics there looked upon as inadequate are subsequently employed as bases for the new genera created. I therefore follow in general the majority of authors writing since Cleve's work appeared, in considering these distinctions of value for subgeneric grouping, though not of generic worth. Especially has Van Heurck[b] grouped the genus Navicula in a way satisfactory to the writer. Exception must, however, be taken to his recognition of the genus Stauroneis Ehrenb. as a genus. As Van Heurck there says, the true Stauroneis forms differ in no respect from Navicula, except "by the central nodule being transversely dilated into a stauros." This has always appeared to me to be a very trivial ground. The stauros is a most common accident of many species in several other genera, as Achnanthes Bory, in *A. coarctata* (Breb.) Grun.;[c] Pleurosigma W. Smith, in *P. asiaticum* Temp. & Brun and *P. staurophorum* Grun.;[d] and Cocconeis Ehrenb., in *C. formosa* Brun.[e] Nor is this any more or less the "dilation of the central nodule" in the one case than in the other. In short, the separation of stauros-bearing forms into a genus is an impossibility, either inside the genus Navicula or outside of it.

I look upon the following genera as having fairly good claim to separate standing: Mastogloia Thwaites, for reasons stated under that genus; Dictyoneis Cleve, on account of its peculiar internal plates and especially its loculate border,[f] though it may possibly be necessary to unite it with Mastogloia; Rouxia Brun & Herib.;[g] also the following six genera, which, although separate from Navicula, should be united under the same generic name: Frustulia C. Ag., in part, Berkeleya (Grev.) Van Heur., Reicheltia Van Heur., Amphipleura Kütz., Brebissonia Grun., Vanheurckia Breb., for all which see under Frustulia in this report; also their figures and descriptions by Van Heurck.[h]

To the foregoing may be added Cleve's genus Cistula;[i] for although it at present includes only the single species *C. lorenziana* (Grun.) Cleve, this is perfectly constant and strikingly unlike other naviculoid diatoms. On the whole the best conception of Navicula and its allies is that of Van Heurck.[j]

Navicula aestiva Donk. Trans. Micr. Soc. Lond. n. s. **6**: 32. *pl. 3. f. 18.* 1858; Brit. Diat. 6. *pl. 1. f. 3.* 1871-73. Schmidt, Atlas *pl. 7. f. 8, 10-11* (unnamed), *pl. 8. f. 26* (type), *f. 31* (unnamed). 1875. Rabh. Fl. Eur. Alg. **1**: 184. 1864. De Toni, Syll.

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[a] Sv. Vet. Akad. Handl. **26^2**: 1894; **27^3**: 1895.

[b] Van Heur. Treat. Diat. 1896.

[c] Van Heur. Synop. *pl. 26. f. 18.* 1881.

[d] Perag. Le Diatomiste **1^{4-5}**: *pl. 8. f. 44-45.* 1891.

[e] Schmidt, Atlas *pl. 193. f. 46.* 1894.

[f] Cf. Sv. Vet. Akad. Handl. **26^2**: 124. 1894; and Van Heur. Treat. Diat. 157. 1896.

[g] Herib. Diat. Auverg. 156. 1893.

[h] Van Heur. Treat. Diat. 239, 242-245. 1896.

[i] Sv. Vet. Akad. Handl. **26^2**: 124. 1894.

[j] Van Heur. Treat. Diat. 162-237. 1896.

Alg. **2:** 93. 1891. O'Meara, Proc. Roy. Irish Acad. II. **2:** 384 (*pl. 32. f. 20.* worthless). 1875. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 94. 1894. Pritch. Hist. Infus. ed. 4. 899. 1861.

Navicula fusca Greg. variety; Schmidt, Atlas *pl. 7. f. 1-4.* 1875; Jahresb. Komm. Deut. Meere **2:** *pl. 8. f. 26.* 1874.

Navicula smithii Breb. variety; Van Heur. Treat. Diat. 198. 1896.

This beautiful form is, as Van Heurck claims, near to *N. smithii* Breb., but is vastly finer and, so far as I have seen, it never shows the double-beaded striae of that species, its striae being delicate and obscurely moniliform. Its resemblance to *N. fusca* (Greg.) Ralfs is also superficial. Schmidt's figures of that species quoted above are quite distinct from Gregory's type, originally published as *N. smithii* Breb. variety *fusca* Greg., its true name, for as Ralfs, who makes it a separate species, says,[a] it "differs from *N. smithii* Breb. in its much larger size and more distinct striae." It is, therefore, even more strongly in contrast with the present species, and I agree with Cleve and De Toni in recognizing its distinctness. The peculiar termination of the two halves of the raphe at the center of the valve[b] is well displayed in a specimen accompanying this report.

Found at station 2920H, Hawaiian Islands.

Navicula anceps (Ehrenb.) Mann.

Stauroneis anceps Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 306, 422. *pl. 2. I. f. 18.* 1843. Kütz. Bacill. 105. *pl. 29. f. 4.* 1844. W. Smith, Synop. Brit. Diat. **1:** 60. *pl. 19. f. 190.* 1853. Brun, Diat. Alp. 89. *pl. 9. f. 1-2.* 1880. Van Heur. Synop. 68. *pl. 4. f. 4-8.* 1881; Treat. Diat. 160. *pl. 1. f. 55-57.* 1896. Schum. Schrift. Phys. Okon. Ges. Königsb. **5:** 22. *pl. 2. f. 27.* 1864. Wolle, Diat. N. A. *pl. 8. f. 4* (not *f. 8-9*). 1890. De Toni, Syll. Alg. **2:** 211. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 147. 1894. Cleve & Grun. Sv. Vet. Akad. Handl. **17**^{2}: 48. *pl. 3. f. 65.* 1880.

Stauroneis amphicephala Kütz. Bacill. 105. *pl. 30. f. 25.* 1844. Pritch. Hist. Infus. ed. 4. 912. 1861. Schum. Schrift. Phys. Okon. Ges. Königsb. 22. *pl. 2. f. 29.* 1864.

Stauroneis linearis Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 300. *pl. 1. II. f. 11.* 1843 ?; Mikrog. *pl. 39. II. f. 106.* 1854.

In adopting the above name to represent this widely known and variable diatom I am led by considerations of policy only. If a strict observance of priority were followed Ehrenberg's *linearis* would probably have to supersede his *anceps*, as the former appears earlier in both the text and plates of his article. Cleve[c] questions the union of *linearis* with this species. To me it seems impossible to diagnose either of them with any accuracy. Certainly the numerous figures of both given by Ehrenberg represent a considerable number of species. And it is because I can not see the boundaries of these two names by means of the original citations that I am unwilling to overturn the above accepted and widely-known specific name for a theoretically earlier one. Diatoms differ from most other organisms in that their minuteness and delicacy of structure are so extreme that only by the finest lenses and the most exact drawings can their specific characteristics be seen and recorded. As a consequence, most of the earlier observations of the more minute diatoms are untrustworthy, and too much weight is attached to the names assigned in these writings. A large part are veritable nomina nuda, and should be given consideration only when subsequent repetitions establish their character. For this reason *anceps* is to be preferred to *linearis*. The union of the Stauroneis diatoms with Navicula has been discussed under the genus.

Found at station 3669H, along Kurile Chain.

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[a] Pritch. Hist. Infus. ed. 4. 898. 1861.

[b] Cf. Schmidt, Atlas *pl. 7. f. 3.* 1875.

[c] Sv. Vet. Akad. Handl. **26**^{2}: 147. 1894.

Navicula antillarum (Cleve & Grun.) Mann.

Alloneis (*Navicula* ?) *antillarum* Cleve & Grun. in Cleve, Bih. Sv. Vet. Akad. Handl. **5**^{8}: 8. *pl. 2. f. 11.* 1878. Castr. Rep. Voy. Chall. Bot. **2**: 35. *pl. 15. f. 5, pl. 20. f. 14, pl. 28. f. 14.* 1886.

Scoliopleura antillarum Pellet. Diat. 288. *f. 231.* 1888–89. De Toni, Syll. Alg. **2**: 265. 1891.

Trachyneis antillarum Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 193. 1894.

Navicula (*Alloneis* ?) *kurzii* Grun.; Cleve, Bih. Sv. Vet. Akad. Handl. **5**^{8}: 8. *pl. 2. f. 12.* 1878.

The last does not seem to me to be a good synonym, but as I have not been able to examine a specimen, and as Cleve himself is the authority for its identity, I must accept his judgment rather than his illustrations.

Found at stations 2823, 2835, Gulf of California and off Lower California.

Navicula omaruensis (Cleve) Mann.

Navicula apis Ehrenb. err. det. Donk. Brit. Diat. 48. *pl. 7. f. 3.* 1871–73. Schmidt, Atlas *pl. 12. f. 16, 18–19, 22–23, 25.* 1875; *pl. 174. f. 13.* 1892. Schmidt, Jahresb. Komm. Deut. Meere **2**: 86. *pl. 1. f. 9.* 1874. not Kütz.

Pinnularia apis Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 420. *pl. 3. VIII. f. 18.* 1843?

Diploneis adonis Brun variety *omaruensis* Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 85. 1894.

Navicula didyma Ehrenb. err. det.; De Toni, Syll. Alg. **2**. 72. 1891.

As Cleve says[a] it is impossible to decide positively what *N. apis* (Ehrenb.) Kütz. really denotes. Ehrenberg's figure and description of *Pinnularia apis* make it reasonably certain that it is not the present species; nor are the synonyms cited by Donkin at all illuminating. Kützing's figure[b] is almost anything but Donkin's diatom, and more unlike it, if possible, is W. Smith's figure determined as *N. didyma* Kütz.[c] I therefore look upon Donkin's form as a distinct species. Although Ehrenberg's name can not be satisfactorily determined, it is inapplicable to the present species as above noted, and as there is so much doubt about Grove and Cleve's identification it may be advisable to drop the name entirely until more accurate information is available. I have therefore selected the name *omaruensis* as the only one tenable. The form called *N. apis* Ehrenb., by Grove and Cleve (?)[d] (Cleve[e] says "Grove & Sturt)," Cleve unites with *N. adonis* Brun, to which it bears no trace of resemblance. De Toni bundles the whole list together under *N. didyma* Ehrenb., giving without comment many utterly irreconcilable figures.[f] That Schmidt recognizes the independent status of Donkin's form is evidenced by the figures given by him under that name.[g]

Found at station 2848, south of Alaska peninsula.

Navicula ardua Mann, sp. nov. PLATE LIII, FIGURES 2, 3.

Valval view long-lanceolate, with sides not curved but proceeding in straight lines from the broad central portion to the rounded apices; costae set at an angle of 45° until very near the apices, then transverse; broader at their outer ends; remote from the raphe, leaving a hyaline line on either side of it; those at the center of the valve slightly shorter, giving thereby a broader hyaline area around the central nodule; zonal view subrectangular, with rounded corners, slightly narrowed at the middle by the depression of the centers of the valves; zone or girdle broad and hyaline.

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[a] Sv. Vet. Akad. Handl. **26**^{2}: 91. 1894.

[b] Kütz. Bacill. *pl. 28. f. 76.* 1844.

[c] W. Smith, Synop. Brit. Diat. **1**: 53. *pl. 17. f. 154a.* 1853.

[d] Schmidt, Atlas *pl. 174. f. 13.*

[e] Sv. Vet. Akad. Handl. **26**^{2}: 85. 1894.

[f] Kütz. Bacill. *pl. 4. f. 7.* and *pl. 28. f. 75.* 1844. Donk. Brit. Diat. *pl. 7. f. 3.* and *pl. 7. f. 8a.* 1871–73.

[g] Schmidt, Jahresb. Komm. Deut. Meere **2**: 86. 1874.

Length of valve, 0.06 mm.; width of valve, 0.01 mm. Costae, 52 in 0.1 mm.

I have named this minute Navicula with reluctance, having tried to bring it into union with several known forms, such as *Gomphonema gracile naviculoides* Grun.,[a] or with *N. tenella* Breb.[b] It could be looked upon as a wide variety of the former of these two, which is the same as *Gomphonema naviculoides* W. Smith, if that diatom were at all like the figure given in Strose,[c] but the identification there is incorrect. The zonal view is beyond question that of a Navicula, and Strose shows his doubt of the name by an interrogation point. My species resembles somewhat a minute specimen of *N. pennata* Schmidt,[d] but the strictly unbeaded costae of my species, as well as the size, precludes a union. Its nearest representative is an unnamed figure of Schmidt's,[e] which it closely resembles except in the matter of the apices.

Type in the U. S. National Museum, No. 590144, from station 2680H off central California, October 11, 1891; 864 fathoms, bottom of brown mud and sand.

Navicula arenaria Donk. Quart. Journ. Micr. Sci. n. s. **1:** 10 *pl. 1. f. 8.* 1861; Brit. Diat. 56. *pl. 8. f. 5a–c.* 1871–73. Rabh. Fl. Eur. Alg. **1:** 177. 1864. Grun.; Schmidt, Atlas *pl. 47. f. 38–40* (not *f. 41*). 1876. Van Heur. Synop. *pl. 8. f. 18.* 1881?. O'Meara, Proc. Roy. Irish Acad. II. **2:** 411. *pl. 34. f. 17.* 1875. Lagers. Bih. Sv. Vet. Akad. Handl. **3**^{15}: 34. 1876. Leud.-Fort. Mem. Soc. Emul. St. Brieuc 23. 1879, not H. L. Smith, Sp. Diat. Typ. no. 250. 1874.

Navicula lanceolata Kütz.; Cleve, Sv. Vet. Akad. Handl. **27**^{3}: 22. 1895. Van Heur. Synop. 88. 1885. De Toni, Syll. Alg. **2:** 58. 1891, not *Cymbella lanceolata* C. Ag.

Although there is similarity between certain figures called *N. lanceolata* (C. Ag.) Kütz. and the above species, I find none that can be considered the same. In fact, I am at a loss to decide what this *lanceolata* of Kützing is specifically. No definite idea can be obtained from the original descriptions and figures,[f] the figures showing a variety of outlines, but devoid of any markings known in Navicula. I notice that Cleve[g] passes over all citations from Kützing and apparently bases his conception of the species on the description and figure in Lagerstedt.[h] If so, it is quite irreconcilable with Donkin's species. I think that here, as in some other cases, Cleve has carried condensation beyond the point of usefulness. The specimens found by me are so exactly Donkin's type that I accept his name as valid.

Found at station 3635H, Bering Sea.

Navicula aspera Ehrenb.; Donk. Brit. Diat. 62. *pl. 10. f. 1a–c.* 1871–73. Van Heur. Synop. 94. *pl. 10. f. 13.* 1881; Suppl. *pl. B. f. 26.* 1885; Treat. Diat. 205, *pl. 4. f. 165.* 1896. Schmidt, Atlas *pl. 48. f. 2–6, 21* (*f. 14–15* doubtful). 1876. Grun. Denkschr. Akad. Wien **48**^{2}: 56. *pl. 1. f. 20.* 1884. Pant. Beitr. Bacill. Ung. **2:** 42. *pl. 10. f. 180.* 1889. Schultze, Bull. Torr. Club **14:** 70. *pl. 66. f. 6.* 1887. De Toni, Syl. Alg. **2:** 109. 1891.

Navicula aspera Ehrenb. Ber. Akad. Wiss. Berl. **1841:** 206. 1842, nom. nud.; Mikrog. *pl. 35A, XX. f. 5.* 1854, as synonym.

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[a] Van Heur. Synop. *pl. 24. f. 13.* 1881.

[b] Van Heur. Synop. *pl. 7. f. 20–21.* 1881.

[c] Strose, Bacillarienlager *pl. 1. f. 18, 21.* 1884.

[d] Schmidt, Atlas *pl. 48. f. 41–43.* 1876.

[e] Op. cit. *pl. 46. f. 65.*

[f] C. Ag. Consp. Diat. 9. 1832. Kütz. Bacill. 94. *pl. 28. f. 38, pl. 30. f. 48.* 1844.

[g] Sv. Vet. Akad. Handl. **26**^{2}: 1894.

[h] Ofv. Kgl. Vet. Akad. **41**$^{2-3}$: 49. *pl. 8. f. 5.* 1884.

Stauroptera aspera Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 299, 387. *pl. 1. I. f. 1–2, pl. 1. III. f. 1–2, pl. 2. VI. f. 20. pl. 4. IV. f. 1* (?). 1843; Mikrog. *pl. 19. f. 26, pl. 35 A. XX. f. 5.* 1854. Bail. Smithson. Contr. Knowl. **7:** *pl. 1. f. 18.* 1854.

Stauroptera achnanthes Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 387. *pl. 3. III. f. 7* (?). *pl. 4. III. f. 2* (?). 1843, not Ehrenb. Mikrog. *pl. 17. I. f. 10.* 1854.

Stauroneis aspera Kütz. Bacill. 106. *pl. 29. f. 12a–b.* 1844.

Stauroneis pulchella W. Smith, Synop. Brit. Diat. **1:** 61. *pl. 19. f. 194a–b.* 1853.

Stauroptera oblonga Bail. Smithson. Contr. Knowl. **7:** 10. *pl. 1. f. 17* (?). 1854. Schmidt, Atlas *pl. 48. f. 16* 1876? Castr. Rep. Voy. Chall. Bot. **2:** 24. *pl. 20. f. 7. 11.* 1886.

Navicula neumeyeri Jan.; Schmidt, Atlas *pl.* 48. *f. 1* 1876?

Navicula pseudoaspera Pant. Beitr. Bacill. Ung. **3:** *pl. 18. f. 258.* 1893.

Trachyneis aspera Cleve, Sv. Vet. Akad. Handl. **26^2:** 191. *pl. 3. f. 37.* 1894.

I have marked several of the above synonyms as doubtful, among them the *S. oblonga* of Bailey, though what Castracane calls by that name is an unquestionable example of the present species. I exclude the following species classed as synonyms by Cleve: *Stauroneis robusta* Petit[a], *Stauroneis pygmea* Castr.,[b] *Navicula contramina* Schmidt,[c] *Navicula residua* Schmidt,[d] *Navicula amphora* Brun.,[e] *Navicula schmidtiana* Grun.[f]

De Toni, though recognizing Stauroneis as a valid genus, considers this particular species to be a Navicula.

Found at stations 2808, 2848, 2920H, 3013H.

Navicula (aspera ?) intermedia Grun.; Schmidt, Atlas *pl. 48. f. 14–15.* 1876.

I mention this variety separately because I think with Schmidt that it is classed with *N. aspera* with much difficulty. I discovered it in different dredgings from those that yielded *N. aspera.*

Found at stations 2807, 2823, 2919, 3611, Galapagos Islands to Bering Sea.

Navicula bisulcata Lagers. Bih. Sv. Vet. Akad. Handl. 1^{14}: 31. *pl. 1. f. 8–9.* 1873. Schmidt, Atlas *pl. 49. f. 15, 17, 18.* 1877. De Toni, Syll. Alg. **2:** 150. 1891.

Neidium bisulcatum Cleve, Sv. Vet. Akad. Handl. **26^2:** 68. 1894.

It has the general build of *N. firma* Kütz., but is of extreme delicacy and fineness of structure. It resembles far less *N. scita* W. Smith,[g] to which Cleve compares it, this latter having dotted and slightly radiating striae and no pronounced hyaline central area.

Found at station 3712H, Okhotsk Sea.

Navicula bombus (Ehrenb.) Kütz. Sp. Alg. 83. 1849. Rabh. Fl. Eur. Alg. **1:** 204. 1864. Greg. Trans. Roy. Soc. Edinb. **21:** 484. *pl. 9. f. 12.* 1857. Donk. Brit. Diat. 50. *pl. 7. f. 7a* (not *f. 7b*). 1871–73. O'Meara, Proc. Roy. Irish Acad. II. **2:** 401. *pl. 33. f. 28.* 1875. Schmidt, Atlas *pl. 69. f. 28–29.* Van Heur. Synop. 90; Suppl. *pl. B. f. 22.* 1885. Pritch. Hist. Infus. ed. 4. 893. 1861. Cleve, in Nordensk. Vega Exped. **3:** 471. 1883. De Toni, Syll. Alg. **2:** 75. 1891. Van Heur. Treat. Diat. 194. *pl. 3. f. 149.* 1896.

Pinnularia bombus Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 30. 1845.

Diploneis bombus Ehrenb. Mikrog. *pl. 19. f. 31.* Cleve, Sv. Vet. Akad. Handl. **26^2:** 90. 1894.

Navicula bombus Ehrenb.; Schmidt, Atlas ed. 2. *pl. 13. f. 4–14, 16.* 1885.

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[a] Fonds de la Mer **3:** 185. *pl. 5. f. 16a–b.* 1877.

[b] Castr. Rep. Voy. Chall. Bot. **2:** 25. *pl. 29. f.* 7. 1886.

[c] Schmidt, Atlas *pl. 48. f. 17–18.* 1876.

[d] Op. cit. *pl. 48. f. 29.*

[e] Mem. Soc. Phys. et Hist. Nat. Geneva **31^1:** 32. *pl. 15. f. 3.* 1891.

[f] Schmidt, Atlas *pl. 48.* (*f. 12–13* unnamed), *f. 19–20.* 1876.

[g] Ann. Mag. Nat. Hist. II. **19:** 8. *pl.* 2. *f.* 4. 1857.

Navicula gemina Kütz. Bacill. 100. 1844?

Navicula gemina Schmidt, Atlas *pl. 13. f. 4–9, 13–14, 16.* 1875; Jahresb. Komm. Deut. Meere **2:** *pl. 1. f. 1* (not *pl. 2. f. 1*). 1874.

This brilliant and massive diatom, though a well-marked species, is represented by many figures so bad as to cause confusion. Some of Schmidt's figures [a] of this as well as of the synonymous *N. gemina* [b] are much too delicately represented, while others [c] are so aberrant as to be difficult of recognition. Wolle's figures [d] are absolutely deceptive. The form called by Donkin [e] "a var. from Northumberland" is evidently an example of *N. didyma* (Ehrenb.) Kütz.,[f] it also being from Northumberland. The best figures of the type are those of Ehrenberg, Van Heurck, and Schmidt,[g] enumerated below.

Schmidt wrote "*N. gemina* A. S." instead of *N. gemina* Kütz. or *N. gemina* (Ehrenb.) Kütz., because, as he states, he was unable to figure out what the older names represented. Cleve avoids the difficulty by omitting any reference to Kützing or to the *Pinnularia gemina* Ehrenb. as figured in Schmidt's Atlas [h] or the *Navicula bombus* Ehrenb. It is, however, certain that all these are the same, unless it be the *P. gemina* Ehrenb., which in its single reference I look upon as a nomen nudum.

Found at stations 2916H, 2920H, Hawaiian Islands.

Navicula brasiliensis Grun. Verh. Zool. Bot. Ges. Wien **13:** 152. *pl. 14. f. 10.* 1863; in Fenzl, Reise Novara Bot. **1:** 19. 1870. Schmidt, Atlas *pl. 6. f. 19–21, 23–25, pl. 6. f. 31–33* (unnamed). 1875. Castr. Rep. Voy. Chall. Bot. **2:** 30. *pl. 20. f. 1–2.* 1886. Pant. Beitr. Bacill. Ung. **2:** 43. *pl. 5. f. 82.* Cleve, Sv. Vet. Akad. Handl. **27^3:** 47. *pl. 1. f. 19.* 1895. De Toni, Syll. Alg. **2:** 55. 1891.

My specimens are identical with some unnamed figures of Schmidt's,[i] which he is disposed to regard as representing a new species. The minute differences he cites for separating these forms from the above, as figured by him on the same plate, are hardly sufficient to mark them as varieties, much less species.

Found at station 2920H, Hawaiian Islands.

Navicula brevis Greg. Trans. Roy. Soc. Edinb. **21:** 478. *pl. 9. f. 4.* 1857. Van Heur. Synop. *pl. 11. f. 18–19.* 1881. Donk. Brit. Diat. 19. *pl. 3. f. 4.* 1871–73. Schmidt, Jahresb. Komm. Deut. Meere **2:** *pl. 2. f. 14–15.* 1874. Pritch. Hist. Infus. ed. 4. 899. 1861. Wolle, Diat. N. A. *pl. 10. f. 7, 17.* De Toni, Syll. Alg. **2:** 123. Cleve, in Nordensk. Vega Exped. **3:** 465. 1883.

Navicula (*brevis* variety ?) *distoma* Grun. in Cleve & Grun. Sv. Vet. Akad. Handl. **17^2:** 30. *pl. 1. f. 25–26.* 1880.

Caloneis brevis Cleve, Sv. Vet. Akad. Handl. **26^2:** 61, 1894.

Cleve mentions as a possible synonym *N. crassa* Greg.[j] In form they are much alike, but I do not regard them as the same. If they were, *N. crassa* would supersede *N. brevis*. Gregory certainly did not consider them the same, and as Cleve & Grunow point out,[k] they are distinguished by the far finer dotting of the striae in *N. brevis*.

Found at station 2885, off Oregon.

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[a] Schmidt, Atlas ed. 2. *pl. 13. f. 7–12.* 1885.

[b] Schmidt, Jahresb. Komm. Deut. Meere **2:** *pl. 2. f. 1.* 1874.

[c] Schmidt, Atlas *pl.* 69. *f. 28–29.* 1881.

[d] Wolle, Diat. N. A. *pl. 10. f. 47–48, 50, pl. 23. f. 3.* 1890.

[e] Donk. Brit. Diat. *pl.* 7. *f. 7b.* 1871–73.

[f] Donk. op. cit. *f. 8.*

[g] Ehrenb. Mikrog. *pl. 19. f. 31.* 1854. Van Heur. Synop. Suppl. *pl. B. f. 22.* 1885. Schmidt, Jahresb. Komm. Deut. Meere **2:** *pl. 1. f. 1a–b.* 1874.

[h] Ber. Akad. Wiss. Berl. *1840:* 214. 1841.

[i] Schmidt, Atlas *pl. 6. f. 31–33.* 1875.

[j] Quart. Journ. Micr. Sci. **3:** 41. *pl. 4. f. 18.* 1855.

[k] Sv. Vet. Akad. Handl. **17^2:** 30. 1880.

Navicula clavata Greg. Trans. Micr. Soc. Lond. n. s. **4**: 46. *pl. 5. f. 17.* 1856. Donk. Brit. Diat. 15. *pl. 2. f. 8.* 1871–73. Schmidt, Atlas *pl. 3. f. 13*, *pl. 70. f.* 50. 1881; *pl. 129. f. 16.* 1888; Jahresb. Komm. Deut. Meere **2**: *pl. 1. f. 33.* 1874. Cleve, Sv. Vet. Acad. Handl. **27**^{3}: 61. 1895. Pritch. Hist. Infus. ed. 4. 848. 1861. O'Meara, Proc. Roy. Irish Acad. II. **2**: 386. *pl. 32. f. 23* (figure poor). 1875.

Navicula wrightii O'Meara, Quart. Journ. Micr. Sci. n. s. **7**: 116. *pl. 5. f. 4* (figure poor). 1867.

Navicula caribaea Cleve; Schmidt, Jahresb. Komm. Deut. Meere, **2**: 89. *pl. 1. f. 40.* 1874; Atlas *pl. 2. f.* 17. 1875; *pl. 70. f. 48.* 1881?

Navicula hennedyi W. Smith; Van Heur. Synop. 93. 1881; Treat. Diat. 204. 1896. De Toni, Syll. Alg. **2**: 104. 1891.

Navicula lyra Ehrenb.; Schmidt, Atlas *pl. 70. f.* 47. 1881. Hab. Cat. 193, 212. 1877.

This diatom stands midway between *N. lyra* Ehrenb. and *N. hennedyi* W. Smith. The union here of O'Meara's *N. wrightii* is justified by Cleve, though the figure in the above citation would not lead one to suspect it, unless it were compared with the equally deceptive figure by O'Meara of *N. clavata*. Most of that author's machine-made illustrations are useless for identification. The specimens found by me are the variety with the spaces between the marginal and median striations strongly granulated instead of hyaline.

Found at station 2807, Galapagos Islands.

Navicula crabro (Ehrenb.) Kütz. Sp. Alg. 83. 1849; W. Smith, Synop. Brit. Diat. 94. 1856. Grev. Quart. Journ. Micr. Sci. **5**: 7. *pl. 3. f. 11.* 1857; Pritch. Hist. Infus. ed. 4. 894. 1861. Rabh. Fl. Eur Alg. **1**: 204. 1864. Grun. Verh. Zool. Bot. Ges. Wien **10**: 524. *pl. 3. f. 21.* 1860; in Fenzl, Reise Novara Bot. **1**: 18. 1870. Donk. Brit. Diat. 46. *pl. 7. f. 1.* 1871–73. Schmidt, Jahresb. Komm. Deut. Meere **2**: *pl. 1. f. 5–6*, *pl. 2. f. 4.* 1874; Atlas *pl. 69. f. 1–4.* 1881; *pl. 174. f. 4*, *6–7.* 1892. De Toni, Syll. Alg. **2**: 68. 1891. Van Heur. Synop. 83. *pl. 9. f. 1–2.* 1881; Treat. Diat. 192. *pl. 3. f.* 144. 1896.

Pinnularia crabro Ehrenb. Ber. Akad. Wiss. Berl. **1844**: 85. 1845. Rabh. Fl. Eur. Alg. **1**: 219. 1864.

Diploneis crabro Ehrenb. Mikrog. *pl. 19. f. 29a–c.* 1854. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 100. *pl. 2. f. 8* (?), *10* (?), *11.* (?) (not *f. 9*). 1894.

Navicula pandura Breb. Mem. Soc. Sci. Nat. Cherb. **2**: 253. *f. 4.* 1854. Schmidt, Jahresb. Komm. Deut. Meere **2**: *pl. 2. f. 3.* 1874; Atlas *pl. 11. f. 1–2*, *4*, *8–9.* 1875. Greg. Trans. Micr. Soc. Lond. n. s. **4**: 43. *pl. 5. f. 11.* 1856. Truan & Witt, Diat. Hayti 17. *pl. 4. f. 14.* 1888.

Pinnularia pandura Greg. Trans. Roy. Soc. Edinb. **21**: 489. *pl. 9. f. 22.* 1857.

Navicula multicostata Grun. Verh. Zool. Bot. Ges. Wien **10**: 524. *pl. 1. f. 13.* 1860 (figure bad). Schmidt, Atlas *pl. 11. f. 14–20*, *pl. 12. f. 71–72.* 1875. De Toni, Syll. Alg. **2**: 69. 1891.

Pinnularia multicostata Rabh. Fl. Eur. Alg. **1**: 219. 1864.

Navicula grevillei Donk. Brit. Diat. 47. 1871–73.

Navicula nitida W. Smith; Greg. Trans. Micr. Soc. Lond. n. s. **4**: 44. *pl. 5. f.* 12* (not *f. 12*).

Navicula dirrhombus Schmidt, Atlas *pl. 11. f. 21–22.* 1875; *pl. 69. f. 9–10.* 1881.

Navicula suspecta Schmidt, Atlas *pl. 11. f. 12–13*, *26–27.* 1875?

Navicula gibelii Schmidt, Atlas *pl. 12. f. 73.* 1875?

Navicula separabilis Schmidt, Atlas *pl. 11. f. 3*, *5–7*, *10*, *17.* 1875.

Navicula expleta Schmidt, Atlas *pl. 69. f. 7–8.* 1881?

Navicula polita Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **31**^{1}: 37. *pl. 15. f. 1.* 1891.

Navicula gloriosa Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **31**^{1}: 34. *pl. 15. f. 8*, *12.* 1891.

Navicula navigans Brun; Schmidt, Atlas *pl. 174. f. 1.* 1892.

Navicula siderialis Schmidt, Atlas; *pl. 174. f. 3.* 1892.

Navicula ornata Schmidt, Atlas *pl. 69. f. 5.* 1875; *pl. 174. f. 25.* 1892.

The above synonymy agrees mainly with that of Cleve.[a] I have, however, placed question marks after some in the list; for although they are near enough to *N. crabro* to suggest their union, I am not satisfied as to the wisdom of uniting them. The following, included by Cleve, I exclude from the list: *N. limitanea* Schmidt,[b] *Diploneis crabro pandurella* Cleve,[c] *N. confecta* Schmidt,[d] *N. mantichora* Pant.[e] This last name is a matter of doubt, there being no text to accompany the figure; but judging from the figure, as I infer Cleve did, I can not take the view that it is a "corroded" specimen of *N. crabro.* Anyone who reads Schmidt's pathetic appeal[f] for guidance out of the labyrinth of confused forms called *N. crabro, N. pandura,* and *N. multicostata* can not but realize that Cleve has done a large and valuable work in simplifying this part of our nomenclature.

Found at stations 2807, 2808, 2920H, 3013H, Galapagos and Hawaiian islands.

Navicula curvilineata Mann, sp. nov. PLATE LII, FIGURE 4.

Valve broadly oval, tapering by nearly straight lines to the subacute apices; raphe extensively curved near the apices toward opposite sides, and sharply bent at the center toward the same side; otherwise straight; markings of large massive beads, so arranged in rows as to give curved lines, oblique to the raphe, in two directions; hyaline space much broader on one side of the raphe than on the other (Alloineis type); a distinct border of strong, closely set lines perpendicular to the margin, broadest at the center of the valve and narrowing proportionately toward its apices; a large hyaline stauros at the center, about one-half the width of the valve.

Length of valve, 0.128 mm.; width of valve, 0.062 mm. Curved oblique striae (at center), 40 to 45 in 0.1 mm.; radiating striae (at center), 75 to 80 in 0.1 mm.

This brilliant diatom has some resemblance to the following species, united by Cleve[g] under the names *Anomoeoneis polygramma* (Ehrenb.) Cleve, *Stauroneis polygramma* Ehrenb.;[h] *Navicula costata* Kütz.;[i] *Navicula bohemica* Ehrenb.,[j] and *Navicula fossilis* Ehrenb.[k]

Type in the U. S. National Museum, No. 590145, from station 2807, Galapagos Islands, April 4, 1888; 812 fathoms, bottom of Globigerina ooze and coral mud.

Navicula cuspidata Kütz. Bacill. 94. *pl. 3. f. 24, 37.* 1844. Rabh. Sussw. Diat. 37. *pl. 5. f. 16.* 1853. W. Smith, Synop. Brit. Diat. **1:** 47. *pl. 16. f. 131.* 1853. Pritch. Hist. Infus. ed. 4. 905 (not *pl. 12. f. 5*). 1861. Donk. Brit. Diat. 39. *pl. 6. f. 6.* 1871–73. O'Meara, Proc. Roy. Irish Acad. **II. 2:** 357, *pl. 31. f. 1.* 1875. Brun, Diat. Alp. 66. *pl. 7. f. 6.* 1880. Van Heur. Synop. 100. *pl. 12. f. 4.* 1881; Suppl. *pl. B. f. 30.* 1885; Treat. Diat. 214. *pl. 4. f. 190–191.* 1896. H. L. Smith, Sp. Diat. Typ. no. 259. 1874. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 109. 1894. Truan, Anal. Soc. Espan. Hist. Nat. **13:** 342. *pl. 7. f. 26.* 1884. De Toni, Syll. Alg. **2:** 136. 1891. Wolle, Diat. N. A. *pl. 12. f. 16.* 1890.

Frustulia cuspidata Kütz. Linnaea **8:** *pl. 2. f. 26.* 1833.

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[a] Sv. Vet. Akad. Handl. **26**^{2}: 100–102. 1894.

[b] Schmidt, Atlas *pl. 11. f. 23.* 1875; *pl. 69. f. 12, 23.* 1881.

[c] Sv. Vet. Akad. Handl. **26**^{2}: 101. *pl. 2. f. 9.* 1894.

[d] Op. cit. *pl. 12. f. 46.*

[e] Pant. Beitr. Bacill. Ung. **3:** *pl. 35. f. 490.* 1893.

[f] Schmidt, Jahresb. Komm. Deut. Meere **2:** 85–86. 1874.

[g] Sv. Vet. Akad. Handl. **27**^{3}: 6. 1895.

[h] Phys. Abh. Akad. Wiss. Berl. **1841:** *pl. 2. VI. f. 30.* 1843.

[i] Kütz. Bacill. 93. *pl. 3. f. 56.* 1844.

[j] Ehrenb. Mikrog. *pl. 10. I. f. 4a.* 1854.

[k] Op. cit. *pl. 10. I. f. 6.*

Navicula ambigua Ehrenb. err. det. ?; W. Smith, Synop. Brit. Diat. **1:** 51. *pl. 16. f. 149. front. f. CXLIX.* 1853. Donk. Brit. Diat. 39. *pl. 6. f. 5.* 1871–73. O'Meara, Proc. Roy. Irish Acad. II. **2:** 360. *pl. 31. f. 10.* 1875. H. L. Smith, Sp. Diat. Typ. no. 243. 1874. Brun, Diat. Alp. 67. *pl. 7. f. 23.* 1880. Van Heur. Synop. 100. *pl. 12. f. 5.* 1881; Treat. Diat. 214. *pl. 4. f. 192.* 1896. Truan, Anal. Soc. Espan. Hist. Nat. **13:** 343. *pl. 7. f. 28.* 1884. Grun. Verh. Zool. Bot. Ges. Wien **10:** 529. *pl. 2. f. 33* (?). 1860. De Toni, Syll. Alg. **2:** 137. 1891 (not Schum. Schrift. Phys. Ökon. Ges. Königsb. **10:** 88. *pl. 2. f. 14.* 1869).

Navicula sphaerophora Kütz.; Grun. Verh. Zool. Bot. Ges. Wien **10:** 540. *pl. 2. f. 34.* 1860.?

Cleve unites *N. ambigua* Ehrenb., adding a question mark, and the same in Kützing,[a] to the above. I can see no reason for this. Ehrenberg's figures are as usual not uniform, but none of them, nor his meager descriptions, warrant their union with this well-marked species. The fact is that a number of authors, mainly those cited above, have given to a variety of *N. cuspidata* having the general outline of some of Ehrenberg's figures, the name *N. ambigua* Ehrenb. The first definite figure and description is by W. Smith[b] and many of the older diatomists have maintained that the name should be credited to him, a procedure entirely out of accord with modern usage. There is, however, no question that his species, so well figured and described, belongs here. De Toni and Brun look upon the two as separate, but Van Heurck and others, while printing their figures and descriptions separately, state that they are probably alike. I have not only examined the many figures but a number of specimens of the two, as H. L. Smith's types, nos. 243 and 259, and find them to be only unimportant varieties.

Cleve also groups here *N. sphaerophora* Kütz.[c] The figure is a little suggestive of that species, but it would be misleading to include this distinct diatom here. His union of *N. birostrata* Greg. and[d] *N. quarnerensis* Grun.[e] is a mistake. It is of interest that both *N. cuspidata* and the variety called as above, *N. ambigua*, afford frequent examples of the internal craticular plates which were formerly known as *Surirella craticula*, *Craticula ehrenbergii*, and *Stictodesmis craticula*. Good figures of this structure are given by Van Heurck and by Heribaud.[f]

Found at station 3607, Bering Sea.

Navicula didyma (Ehrenb.) Kütz. Bacill. 100. *pl. 4. f. VII. 1–2, pl. 28. f. 75.* 1844. Pritch. Hist. Infus. ed. 4. 893. *pl. 7. f. 61; pl. 15. f. 12.* 1861. Van Heur. Synop. 90. *pl. 9. f. 5–6.* 1881; Suppl. *pl. B. f. 20.* 1885; Treat. Diat. 193. *pl. 3. f. 147.* 1896. W. Smith, Synop. Brit. Diat. **1:** 53. *pl. 17. f. 154, Front. f. CLIV.* 1853. Donk. Brit. Diat. 51. *pl. 7. f. 8b* (not *f. 8a*). 1871–73. Rabh. Fl. Eur. Alg. **1:** 203. 1864. Schmidt, Jahresb. Komm. Deut. Meere **2:** 85. *pl. 1. f. 7a–b.* 1874. Schmidt, Atlas *pl. 13. f. 1–3.* 1875 (not *pl. 69. f. 30, 37–39.* 1881). O'Meara, Proc. Roy. Irish Acad. II. **2:** 402 (not *pl. 33. f. 29*). 1875. H. L. Smith, Sp. Diat. Typ. no. 265. 1874. De Toni, Syll. Alg. *2:* 71. 1891.

Navicula (*Pinnularia*) *didyma* Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1839:** 155. 1841.

Pinnularia didyma Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 383. *pl. 2. IV. f. 3, pl. 2. VI. f. 24, pl. 3. VII. f. 19* (?). 1843. Jan., Schles. Ges. Vaterl. Cult. **1862**^{2}: 28. *pl. 2B. f. 13.* 1862.

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[a] Kütz. Bacill. 95. *pl. 28. f. 66.* 1844.

[b] W. Smith, Synop. Brit. Diat. **1:** 51. *pl.* 16. *f. 149.* 1853.

[c] Donk. Brit. Diat. 34. *pl. 5. f. 10.* 1871–73.

[d] Quart. Journ. Micr. Sci. **3:** 40. *pl. 4. f. 15.* 1855.

[e] Verh. Zool.-Bot. Ges. Wien **10:** 530. *pl. 3. f. 8.* 1860.

[f] Van Heur. Synop. *pl. 12. f. 6.* 1881; Treat. Diat. *pl. 4. f. 193.* 1896. Herib. Diat. Auverg. *pl. 4. f. 15.* 1893.

Diploneis didyma Ehrenb. Mikrog. *pl. 18.f. 69* (?), *pl. 19.f. 32*, *pl. 21.f. 34* (?), *pl. 22. f. 60* (?). 1854. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 90. 1894.

Here again it is a question if Ehrenberg should be quoted as the author of this name. A bare reference to *Pinnularia didymus* is followed by a confusion of irreconcilable figures. That a well-understood conception has grown around this name is certain, but that it matches Ehrenberg's form or forms can not be proved. Cleve drops Ehrenberg out of the category, except for the original reference. De Toni masses the heterogeneous lot from Ehrenberg and other authors without comment. He also includes here *N.* (*Pinnularia*) *apis* Ehrenb. a thing not to be commended. There are a large number of diatoms of this general build, and the above species doubtless grades off into *N. bombus* (Ehrenb.) Kütz. on the one hand and *N. splendida* Greg. on the other. Their drawings are still more liable to overlap. But aside from the fact that *N. apis* Ehrenb. is an indefinite quantity, the modern conception of it in Kützing, Donkin, and others can not be joined with this species.

Found at station 3008H, Hawaiian Islands.

Navicula distans (W. Smith) Ralfs, Pritch. Hist. Infus. ed. 4. 907. 1861. Schmidt, Jahresb. Komm. Deut. Meere **2**: 91. *pl. 2. f. 38* (unnamed). 1874. Schmidt, Atlas *pl. 46. f. 11–14.* 1876. O'Meara, Proc. Roy. Irish Acad. II. **2**: 343 (not *pl. 30. f. 6*). 1875. Cleve, Bih. Sv. Vet. Akad. Handl. **1**^{13}: 17. 1873. Grun. in Cleve & Grun. Sv. Vet. Akad. Handl. **17**^{2}: 38. *pl. 2. f. 42.* 1880. Grun. Denkschr. Akad. Wien **48**^{2}: 55. *pl. 1. f. 26.* 1884. Van Heur. Synop. Suppl. 87. *pl. A. f. 18.* 1885; Treat. Diat. 185. *pl. 3. f. 133.* 1896. De Toni, Syll. Alg. **2**: 53. 1891. Cleve, Sv. Vet. Akad. Handl. **27**^{3}: 35. 1895.

Pinnularia distans W. Smith, Synop. Brit. Diat. **1**: 56. *pl. 18. f. 169.* 1853. Rabh. Fl. Eur. Alg. **1**: 217. 1891.

Found at stations 3526, 3604, 3635H, 3692H, Bering and Okhotsk seas.

Navicula fluminensis Grun. Verh. Zool. Bot. Ges. Wien **10**: 520. *pl. 1. f. 7.* 1860. Cleve, in Nordensk. Vega Exped. **3**: 463. 1888. Cleve & Grun. Sv. Vet. Akad. Handl. **17**^{2}: 28. *pl. 1. f. 12.* 1880. De Toni, Syll. Alg. **2**: 111. 1891.

Navicula (*fluminensis* var.?) *floridana* Cleve, Sv. Vet. Akad. Handl. **18**^{5}: 6. *pl. 1. f. 10.* 1881. De Toni, Syll. Alg. **2**: 35. 1891.

Navicula loczyi Pant. Beitr. Bacill. Ung. **2**: 51. *pl. 6. f. 114.* 1889.

Cleve makes this a variety of *Pinnularia quadratarea* (Schmidt) Cleve,[a] which is his own *N. pinnularia.*[b] He says, however, regarding *N. fluminensis:* "I have not seen original specimens and am therefore uncertain whether this form belongs to *P. quadratarea* or whether it is a Caloneis." It has no likeness to that form, except in its having the transverse striae interrupted by a stauros at the center. My specimen is much larger than any observed by Grunow, his largest (variety *kuguelensis*) being 0.057 mm. long, while mine is 0.085 mm. long. But Cleve's *N. floridana* and Pantocsek's *N. loczyi* approach it, the former being 0.075mm. and the latter 0.081mm. long.

Found at station 3692H, Okhotsk Sea.

Navicula formosa Greg. Trans. Micr. Soc. Lond. n. s. **4**: 42. *pl. 5. f. 6.* 1856. Schmidt, Atlas *pl. 50. f. 9–14* (not *f. 8*, *15*). 1877. H. L. Smith, Sp. Diat. Typ. no. 274. 1874. Pritch. Hist. Infus. ed. 4. 909. 1861. Van Heur. Synop. 102. *pl. 11. f. 2.* 1881–85; Treat. Diat. 218. *pl. 5. f. 199.* 1896. De Toni, Syll. Alg. **2**: 142. 1891.

Pinnularia oregonica Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1870**: *pl. 2. I. f. 10* 1871.

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[a] Sv. Vet. Akad. Handl. **27**^{3}: 96. 1895.

[b] Öfv. Kgl. Vet. Akad. Forhandl. **25**: 224, *pl. 4. f. 1–2.* 1868.

Navicula holmiensis Cleve, Sv. Vet. Akad. Handl. **18**^{6}: 8. *pl. 2. f. 18.* 1881.
Navicula liburnica Grun.; Van Heur. Synop. 102. *pl. 11. f. 3.* 1881–85.
Caloneis formosa Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 57. 1894.

The truly transverse striae of *N. formosa fossilis* Pant.[a] makes it a questionable reference to the above. Cleve puts it in *Caloneis liber* (W. Smith) Cleve.[b] Gregory's original figure is a little more coarsely striated than normal.

Found at station 2929, off southern California.

Navicula gemmata Grev. Edinb. New Phil. Journ. n. s. **10**: 30. *pl. 4. f. 7.* 1859. Grun. in Fenzl, Reise Novara Bot. **1**: 100. *pl. 1A. f. 16.* 1870. Schmidt, Atlas *pl. 8. f. 38, 42.* 1875; *pl. 70. f. 74* (unnamed). 1882. Pant. Beitr. Bacill. Ung. **1**: 25. *pl. 20. f. 181.* 1886. De Toni, Syll. Alg. **2**: 69. 1891.
Diploneis gemmata Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 98. 1894.
Navicula pseudogemmata Pant. Beitr. Bacill. Ung. **3**: *pl. 29. f. 420.* 1893.
Navicula grunowii Rabh. err. det. Schmidt, Atlas *pl. 70. f. 73.* 1882.
Navicula pristiophora Schmidt, Atlas *pl. 70. f. 72.* 1882.
Navicula mediterraneana Grun.; Schmidt, Atlas *pl. 8. f. 40.* 1875 (?); Jahresb. Komm. Deut. Meere **2**: *pl. 2. f. 10.* 1874.
Navicula eudoxia Schmidt, Atlas *pl. 8. f. 39.* 1875; *pl. 70. f. 71.* 1882.
Navicula chimmoana O'Meara, Quart. Journ. Micr. Sci. n. s. **12**: 285. *pl. 13. f. 1.* 1872. Moeb. Diat.-taf. *pl. 81. f. 1.* 1890.
Navicula suluensis O'Meara, Quart. Journ. Micr. Sci. n. s. **12**: 285. *pl. 13. f. 2.* 1872. Moeb. Diat.-taf. *pl. 81. f. 2.* 1890.
Navicula bipunctata O'Meara, Quart. Journ. Micr. Sci. n. s. **12**: 286. *pl. 13. f. 5.* 1872. Moeb. Diat.-taf. *pl. 81. f. 5.* 1890 ?
Navicula unipunctata O'Meara (?) Quart. Journ. Micr. Sci. n. s. **12**: 286. *pl. 13. f. 4.* 1872. Moeb. Diat.-taf. *pl. 81. f. 4.* 1890.

I exclude from the above the following included by Cleve: *N. basilica* Brun[c] and *N. spectabilis* Grun.[d] This last is a preempted name, having been used by Gregory in 1856. Rabenhorst therefore renamed it *N. grunowii.*[e] It is not the same as the form so called by Schmidt, which is included here.

Found at station 2920H, Hawaiian Islands.

Navicula graeffii Grun.; Schmidt, Atlas *pl. 7. f. 5–6.* 1875. De Toni, Syll. Alg. **2**: 94. 1891.
Diploneis graeffii Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 93. 1894.

Found at station 4516H, Gulf of California.

Navicula gyrinida Mann, sp. nov. PLATE LII, FIGURE 6.

Valve broadly oval, curving from the center to the rounded ends; markings moniliform striae, extending from the margin to a line inclosing a spindle-shaped central area; this area ribbed transversely with smooth striae confluent with the outer moniliform striae, these last being radiate; a minute H-shaped hyaline central space.

Length of valve, 0.054 mm.; width of valve, 0.035 mm.

This species is close to the unnamed figure of Schmidt's,[f] of which he says, "mit *N. elliptica* schwerlich zu vereinen." It is certainly impossible to call it *N. elliptica* Kutz.[g] Nor can it be either of the irreconcilable figures of *N. elliptica* W. Smith.[h]

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[a] Pant. Beitr. Bacill. Ung. **2**: 46. *pl. 20. f. 310.* 1889.

[b] Sv. Vet. Akad. Handl. **26**^{2}: 55. 1894.

[c] Mem. Soc. Phys. et Hist. Nat. Geneva **31**^{1}: 32. *pl. 15. f. 14.* 1891.

[d] Verh. Zool. Bot. Ges. Wien **10**: 533. *pl. 1. f. 11.* 1860.

[e] Rabh. Fl. Eur. Alg. **1**: 203. 1864.

[f] Schmidt, Atlas *pl. 7. f. 24.* 1875.

[g] Kütz. Bacill. 98. *pl. 30. f. 55.* 1844, and Van Heur. Synop. *pl. 10 f. 10.* 1881.

[h] W. Smith, Synop. Brit. Diat. **1**: 48. *pl. 17. f. 152.* 1853.

The name here given refers to its resemblance in outline and convexity to the water-beetle, Gyrinida.

Type in the U. S. National Museum, No. 590146, from station 2807, Galapagos Islands, April 4, 1888; 812 fathoms, bottom of Globigerina, ooze and coral mud.

Navicula hennedyi W. Smith, Synop. Brit. Diat. **2**: 93. 1853. Greg. Trans. Micr. Soc. Lond. n. s. **4**: 40. *pl. 5. f. 3.* 1856. Grun. Verh. Zool. Bot. Ges. Wien **10**: 532. *pl. 1. f. 21–22.* 1860. Donk. Brit. Diat. 11. *pl. 2. f. 3.* 1871–73. Schmidt, Jahresb. Komm. Deut. Meere **2**: 89. *pl. 1. f. 41.* 1874. Schmidt, Atlas *pl. 3. f. 3–5, 17, 18.* 1875; *pl. 129. f. 10.* 1888. Van Heur. Synop. 93. *pl. 9. f. 14.* 1881; Treat. Diat. 204. *pl. 4. f. 160, pl. 27. f. 755.* 1896. Jan. Diat. Gaz. Exped. *pl. 15. f. 14.* Pritch. Hist. Infus. ed. 4. 898. *pl. 7. f. 69.* 1861. Witt, Verh. Russ. Min. Ges. II. **2**: 29. *pl. 9. f. 5.* 1886. O'Meara, Proc. Roy. Irish Acad. II. **2**: 387. *pl. 32. f. 241.* 1875. Rabh. Fl. Eur. Alg. **1**: 178. 1864. Leud.-Fort. Mem. Soc. Emul. St. Brieuc 29. *pl. 8. f. 88.* 1879 (?). Pant. Beitr. Bacill. Ung. **2**: 47. *pl. 12. f. 207.* 1889. Cleve, Sv. Vet. Akad. Handl. **18**^{5}: 7. *pl. 1. f. 14–15* (not *pl. 2. f. 19*). 1881; **27**^{3}: 57. 1895; **26**^{2}: *pl. 4. f. 14.* 1894. De Toni, Syll. Alg. **2**: 103. 1891. Petit, Fonds de la Mer **3**: 182. *pl. 4. f. 13.* 1877 (?).

Navicula nebulosa Greg. Trans. Roy. Soc. Edinb. **21**: 480. *pl. 9. f. 8.* 1857. Donk. Brit. Diat. 11. *pl. 2. f. 2.* 1871–73. Schmidt, Atlas *pl. 3. f. 14.* 1875; *pl. 70. f. 44.* 1881. Cf. Van Heur. Treat. Diat. 204. *pl. 27. f. 755.* 1896.

Navicula californica Grev. Edinb. New Phil. Journ. n. s. **10**: 29. *pl. 4. f. 5.* 1859. Grun.; Schmidt, Atlas *pl. 3. f. 6, 19.* 1875.

Navicula polysticta Grev. err. det. Schmidt, Atlas *pl. 3. f. 26–28.* 1875. Schmidt, Jahresb. Komm. Deut. Meere **2**: 89. *pl. 1. f. 36, 42.* 1874. Cf. Edinb. New Phil. Journ. **10**: 28. *pl. 4. f. 2.* 1859.

Navicula bacillifera Pant. Beitr. Bacill. Ung. **2**: 42. *pl. 5. f. 80.* 1889.

Navicula (*hennedyi* var. ?) *caliginosa* Cleve. & Grove, Le Diatomiste **1**: 67. *pl. 10. f. 9.* 1891.

Navicula perennis Pant. Beitr. Bacill. Ung. **3**: *pl. 41. f. 560.* 1893.

This widely distributed diatom is most variable and grades off so gradually into forms so different from the type that it is out of the question to draw a boundary line around this species. It merges into *N. praetexta* Ehrenb. and *N. lyra* Ehrenb. I have excluded from the synonymy such species as seem to me too wide of the ideal to be in any way confused with it; though I recognize that there are transitional forms in nearly every instance. For this reason I do not include *N. sandriana* Grun.,[a] *N. fallax* Cleve,[b] *N. schleinitzii* Jan.,[c] and it is with some uncertainty that I have followed the lead of Cleve in classing the very delicate *N. nebulosa* Greg. with the above. This last occurs plentifully at station 2807 and W. Smith's type at stations 2807 and 2835.

Found at stations 2807, 2808, 2835, 2920H, Galapagos and Hawaiian islands and off Lower California.

Navicula impressa Grun.; Schmidt, Atlas *pl. 6. f. 17–18.* 1875. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 50, 1894. De Toni, Syll. Alg. **2**: 134. 1891. Schmidt, Atlas *pl. 6. f. 36* (unnamed). 1875.

My specimen is an unsatisfactory example of this diatom. It agrees accurately with Schmidt's unnamed figure cited above. Though I share the doubt of Schmidt of this being identical with any known species, I think the similarity to the above is too close to admit of maintaining here two good species. Lagerstedt[d] has given this name by mistake to a variety of *N. cancellata* Donk.

Found at station 3712H, Okhotsk Sea.

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[a] Verh. Zool. Bot. Ges. Wien **13**: 153. *pl. 4. f. 5.* 1863.

[b] Sv. Vet. Akad. Handl. **26**^{2}: 135. *pl. 5. f. 27.* 1894.

[c] Schmidt, Atlas *pl. 70. f. 48.* 1881; Jan. Diat. Gaz. Exped. *pl. 15. f. 1.*

[d] Bih. Sv. Vet. Akad. Handl. **3**^{15}: 33. *pl. 1. f. 3.* 1876.

Navicula invenusta Mann, sp. nov. PLATE LIII, FIGURES 6, 7.

Valve elliptical, broad, massive; costae punctate with a double row of *alternating* minute beads; the inner ends of the costae forming a straight line parallel to the raphe; an irregularly placed row of large beads near the inner ends of the costae; sutures between the costae projected inward, with enlarged ends, the three on either side of the hyaline central space extending farther than the rest; a single row of round beads bordering the median line, the latter terminating in a rectangular hyaline area at each apex.

Length of valve, 0.120 to 0.165 mm.; width of valve, 0.040 to 0.056 mm.

The larger of the two specimens photographed for the above figures was selected because, being slightly tilted, it shows the two kinds of beading previously mentioned.

Type in the U. S. National Museum, No. 590147, from station 2807, Galapagos Islands, April 4, 1888; 912 fathoms, bottom of Globigerina ooze and coral mud.

Navicula irrorata Grev. Edinb. New Phil. Journ. n. s. **10**: 27. *pl. 4. f. 1.* 1859. Schmidt, Atlas *pl. 2. f. 19, 22–23.* 1875. Cleve, Sv. Vet. Akad. Handl. **27**^{3}: 56. 1895; **26**^{2}: *pl. 4. f. 13.* 1894. De Toni, Syll. Alg. **2**: 100. 1891. Pant. Beitr. Bacill. Ung. **2**: 49. *pl. 8. f. 147.* 1889. Pritch. Hist. Infus. ed. 4. 897. 1861.

Navicula approximata Grev.; Grun. in Schmidt, Atlas *pl. 2. f. 20.* 1875.

Such varieties as Schmidt's figure 19, cited above, show the transition of this species into varieties of *N. sculpta* W. Smith.[a]

Found at station 2823, Gulf of California.

Navicula lacrimans Schmidt, Atlas *pl. 12. f. 59–61.* 1875. Pant. Beitr. Bacill. Ung. **2**: 50. *pl. 2. f. 18.* 1889. De Toni, Syll. Alg. **2**: 70. 1891.

Diploneis gemmulata Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 104. 1894, not *Navicula gemmulata* Grun.; Schmidt, Atlas *pl. 13. f. 20–21.* 1875.

Cleve's union of the first two of the three figures of Schmidt, cited above, with Grunow's *Navicula gemmulata* is not to be commended. First of all, the three represent one species; then, further, they are widely different from *N. gemmulata* Grun. It may be added that his joining with these *N. taschenbergeri* Schmidt[b] and *N. beyrichiana* Schmidt[c] is equally bad. Later[d] he held the last-named separate.

Found at station 2807, Galapagos Islands.

Navicula lata (Breb.) W. Smith, Synop. Brit. Diat. **1**: 55. 1853. Donk. Brit. Diat. 71. 1871–73. Schum. Verh. Zool. Bot. Ges. Wien **17**: 73. *pl. 4. f. 54.* 1867. Grun. Verh. Zool. Bot. Ges. Wien **10**: 515. 1860. Van Heur. Synop. 76. *pl. 6. f. 1–2.* 1881; Treat. Diat. 169. *pl. 2. f. 76.* 1896. De Toni, Syll. Alg. **2**: 18. 1891. Grun. Denkschr. Akad. Wien **48**^{2}: 98. *pl. 1. f. 14–17.* 1884. Herib. Diat. Auverg. 86. *pl. 4. f. 5.* 1893. H. L. Smith, Sp. Diat. Typ. no. 289. 1874. Pritch. Hist. Infus. ed. 4. 908. 1861, not Kütz. Bacill. 92. *f. 51.* 1844

Frustulia lata Breb. Consid. Diat. 18. 1838.

Pinnularia pachyptera Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 421. *pl. 4. II. f. 9.* 1843; Mikrog. *pl. 38A. XVII. f.* 7 (not *pl. 35A. f. 17*). 1854. Rabh. Sussw. Diat. 45. *pl. 6. f. 11.* 1853. Bail. in Fremont, Rep. Expl. Exped. 1842–44. 302. *pl. 5. f. 6.* 1845.

Navicula pachyptera Kütz. Bacill. 98. *pl. 28. f. 58.* 1844. Pritch. Hist. Infus. ed. 4. 896. 1861. O'Meara, Proc. Roy. Irish Acad. II. **2**: 342. *pl. 30. f. 5.* 1875. Schmidt, Atlas *pl. 45. f. 5–8.* 1845. Pant. Beitr. Bacill. Ung. **3**: *pl. 20. f. 302.* 1893.

Pinnularia lata W. Smith, Synop. Brit. Diat. **1**: 55. *pl. 18. f. 167.* 1853. Rabh. Sussw. Diat. 42. 1853; Fl. Eur. Alg. **1**: 212. 1864. Brun, Diat. Alp. 85. *pl. 8. f. 25.* 1880. Cleve, Sv. Vet. Akad. Handl. **27**^{3}: 81. 1895.

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[a] Van Heur. Synop. *pl. 12. f. 1.* 1881.

[b] Op. cit. *pl. 174. f. 8–9.*

[c] Op. cit. *pl. 69. f. 16–17.*

[d] Journ. Quck. Micr. Club II. **2**: 167. 1885.

Pinnularia megaloptera Ehrenb. Mikrog. *pl. 3. I. f. 4, III. f. 2.* 1854; Phys. Abh. Akad. Wiss. Berl. **1870:** *pl. 3. I. f. 16.* 1871.

Navicula megaloptera Herib. Diat. Auverg. 88. *pl. 4. f. 6.* 1893.

Navicula costata Ehrenb.; Herib. Diat. Auverg. 87. *pl. 4. f. 7.* 1893, not Kütz. 1844.

A mistake that is constantly being repeated is the uniting of Kützing's figure with this species, to which it has not the remotest resemblance. It is the same as *N. microstoma* Kütz.,[a] which is only a variety of *N. firma* Kütz., as De Toni[b] and others point out. Nevertheless, De Toni,[c] after recognizing this fact, quotes this error of Kützing. Cleve falls into the same mistake, though omitting any reference to the figure of Kützing, his diagnosis being in perfect harmony with his figure. Both Donkin and O'Meara in the above citations note the mistake made by Kützing.

Found at station 3611, Bering Sea.

Navicula lyra Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 419. *pl. 1. I. f. 9a.* 1843. Kütz. Bacill. 94. *pl. 28. f. 55.* 1844. Greg. Trans. Roy. Micr. Soc. Edinb. **21:** 485. *pl. 9. f. 13–14b.* 1857. Jan. & Rab. in Rabh. Beitr. **1:** 10. *pl. 3. f. 7.* 1863. Jan. Abh. Schl. Ges. Vaterl. Cult. **1862**^{2}: *pl. 1A. f. 26.* 1862. W. Smith, Synop. Brit. Diat. **1:** *pl. 17. f. 152a**. 1853; **2:** 93. 1856. Pritch. Hist. Iufus. ed. 4. 897. 1861. Donk. Brit. Diat. 14. *pl. 2. f. 7.* 1871–73. Schmidt, Atlas *pl. 2. f. 4–5, 8–9, 16, 18* (not *f. 29–33, f. 25–27* doubtful). 1875; Jahresb. Komm. Deut. Meere **2:** *pl. 1. f. 34–35, 38–39* (all doubtful). 1874. Rabh. Fl. Eur. Alg. **1:** 177. 1864. Van Heur. Synop. 93. *pl. 10. f. 1–2.* 1881–85; Treat. Diat. 203. *pl. 4. f. 161.* 1896. Jan. Diat. Gaz. Exped. *pl. 15. f. 8–9, 13.* Cleve, Bih. Sv. Vet. Akad. Handl. **5**^{8}: 4. *pl. 1. f. 1.* 1878; Sv. Vet. Akad. Handl. **27**^{3}: 63. 1895. De Toni, Syll. Alg. **2:** 95. 1891. Pant. Beitr. Bacill. Ung. **1:** 27. *pl. 17. f. 150.* 1886; **2:** 50. 1889; **3:** *pl. 33. f. 466, 468, pl. 34. f. 479.* 1893. Grev. Edinb. New Phil. Journ. n. s. **10:** 28. *pl. 4. f. 3.* 1859. Castr. Rep. Voy. Chall. Bot. **2:** 33. *pl. 30. f. 13.* 1886. Truan, Anal. Soc. Espan. Hist. Nat. **13:** 44. *pl. 8. f. 23–24.* 1884. Grun. Verh. Zool. Bot. Ges. Wien **10:** 532. *pl. 3. f. 22* (not *f. 23*). 1860. H. L. Smith, Sp. Diat. Typ. no. 292. 1874. Wolle, Diat. N. A. *pl. 16. f. 4, 6, 9, 14, 26.* 1890.

Navicula bullata Norm., Trans. Micr. Soc. Lond. n. s. **9:** 8. *pl. 2. f. 7.* 1861. Moeb. Diat.-taf. *pl. 36. f. 7.* 1890. Schmidt, Atlas *pl. 3. f. 8–9.* 1875. Castr. Rep. Voy. Chall. Bot. **2:** 29. *pl. 28. f. 7* (not *f. 10*), *pl. 30. f. 7.* 1886.

Pinnularia couperii Bail. Smithson. Contr. Knowl. **2**^{8}: 39. *pl. 2. f. 33.* 1851.

Navicula couperi Bail.; Schmidt, Atlas *pl. 2. f. 12.* 1875?

Navicula zanzibarica Grev. Trans. Micr. Soc. Lond. n. s. **14:** 129. *pl. 12. f. 22.* 1866. Schmidt, Atlas *pl. 2. f. 3.* 1875. Castr. Rep. Voy. Chall. Bot. **2:** 31. *pl. 28. f. 8.* 1886.

Navicula robertsoniana Grev. Trans. Bot. Soc. Edinb. **8:** 235. *pl. 3. f. 9.* 1866. Schmidt, Atlas *pl. 2. f. 7, 11.* 1875. Wolle, Diat. N. A. *pl. 16. f. 8.* 1890.

Navicula durandii Kitt.; Schmidt, Atlas *pl. 129. f. 1–3.* 1888.

I have not included here the reference in O'Meara,[d] because all six figures are worse than worthless. Nor is Schmidt's figure, cited above and called *N. couperi* Bail., like the original or a good example of *N. lyra.* Cleve adds *N. seductilis* Schmidt,[e] which I also omit. It is plain that this polymorphic form has no hard and fixed boundaries, and that what is to be included or what not must always be somewhat a matter of personal preference. I feel that in this and similar cases condensation ought to be carried only so far as that the average student will be more likely to pick out the species assigned than any other. Where, in other words, the relationship begins to seem forced, I think it is time to stop. Thus it seems to me that Schmidt's figure 34,[a] though clearly grading into *N. lyra*, would be more likely to be taken for *N. forcipata* Grev.[b] I therefore classify it so, Greville's species not being considered by anyone to be synonymous with *N. lyra*. Cleve gives 25 named varieties of *N. lyra*. I omit these. They could easily be increased to 100; but our nomenclature will soon change from binomial to trinomial if this plan becomes a general one.

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[a] Kütz. Sp. Alg. 71. 1849.

[b] De Toni, Syll. Alg. **2:** 155. 1891.

[c] Op. cit. 18.

[d] Proc. Roy. Irish Acad. II. **2:** 391. *pl. 33. f. 1–6.* 1875.

[e] Schmidt, Atlas *pl. 2. f. 35–36.* 1875.

Found at stations 2694H, 2807, 2808, 2835, 2920H, 3013H, 3604, 3635H, 4014H, Galapagos Islands to Bering Sea and off Honshu Island, Japan.

Navicula major Kütz. Bacill. 97. *pl. 4. f. 19–20.* 1844. Donk. Brit. Diat. 69. *pl. 11. f. 2.* 1871–73. Van Heur. Synop. 73. *pl. 5. f. 3–4.* 1881; Treat. Diat. 165. *pl. 2. f. 69.* 1896. Schmidt, Atlas *pl. 42. f. 8.* 1876 (all other figures doubtful). Pant. Beitr. Bacill. Ung. **3**: *pl. 7. f. 113.* 1893. De Toni, Syll. Alg. **2**: 10. 1891. H. L. Smith, Sp. Diat. Typ. no. 294. 1874. Truan, Anal. Soc. Espan. Hist. Nat. **13**: 341. *pl. 7. f. 20.* 1884. Pritch. Hist. Infus. ed. 4. 896. *pl. 7. f. 65.* 1861.

Frustulia major Kütz. Linnaea **8**: 547. *f. 25.* 1833 ?

Pinnularia major W. Smith, Synop. Brit. Diat. **1**: 54. *pl. 18. f. 162.* 1853. Rabh. Sussw. Diat. 42. *pl. 6. f. 5.* 1853. Cleve, Sv. Vet. Akad. Handl. **27^3**: 89. *pl. 1. f. 22.* 1895.

Navicula heroina Schmidt, Atlas *pl. 43. f. 2.* 1876.

Navicula nobilis Ehrenb.; Brun, Diat. Alp. 84. *pl. 8. f. 1.* 1880.

Navicula transversa Schmidt, Atlas *pl. 43. f. 5–6.* 1876 (?).

Navicula viridis Ehrenb. Infus. 182. *pl. 13. f. 16* (not *pl. 21. f. 12*). 1838, in part; Phys. Abh. Akad. Wiss. Berl. **1837**: *pl. 1. f. 19.* 1839. Bail. Am. Journ. Sci. **42**: 96. *pl. 1. f. 16.* 1842.

Here we meet a problem of specific limitation that is particularly difficult. I have in the main followed the arrangement of Cleve,[c] though it leaves much to be desired. *Pinnularia subacuta* Ehrenb.[d] I do not include here. But aside from this, the question of what distinction can be drawn between the above and *N. dactylus* (Ehrenb.) Kütz., also *N. nobilis* (Ehrenb.) Kütz., is not satisfactorily answered. De Toni[e] unites *N. dactylus* and *N. nobilis*, but separates them from *N. major*. All these, as well as figures of *N. viridis* (Ehrenb.) Kütz. are without any lines of separation from each other. Schmidt says[f] "*Pinn. viridis* und *dactylus*, E., *N. major* und *viridis*, K. verschwimmen so in einander, dass sich ein genügender Nachweiss über ihr Verhältniss zu einander gar nicht geben lässt."

Found at stations 2848, 2929, south of Alaska peninsula and off southern California.

Navicula nitescens (Greg.) Ralfs, Pritch. Hist. Infus. ed. 4. 898. 1861. Donk. Brit. Diat. 8. *pl. 1. f.* 7. 1871–73. Schmidt, Atlas *pl.* 7. *f. 37–41*, *pl. 8. f. 14–16* (unnamed). 1875. Jan. & Rabh. in Rabh. Beitr. **1**: 10. *pl. 2. f.* 7. 1863. O'Meara, Proc. Roy. Irish Acad. II. **2**: 389. *pl. 32. f. 32.* 1875. De Toni, Syll. Alg. **2**: 91. 1891. Van Heur. Treat. Diat. 198. *pl. 26. f. 747.* 1896. Pant. Beitr. Bacill. Ung. **2**: 53. *pl. 9. f. 163.* 1889.

Diploneis nitescens Cleve, Sv. Vet. Akad. Handl. **26^2**: 97. 1894.

Navicula smithii Breb. variety; Greg. Trans. Roy. Soc. Edinb. **21**: 487. *pl. 9. f. 16.* 1857.

Navicula adriatica Grun. Verh. Zool. Bot. Ges. Wien **10**: 525. *pl. 1. f. 17.* 1860.

Pinnularia arraniensis O'Meara, Quart. Journ. Micr. Sci. **14**: 116. *pl. 5. f. 6.* 1867.

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[a] Schmidt, Atlas *pl. 2. f. 34.* 1875.

[b] Quart. Journ. Micr. Sci. **7**: 83. *pl. 6. f. 10–11.* 1859.

[c] Sv. Vet. Akad. Handl. **27^3**: 89. 1895.

[d] Ehrenb. Mikrog. *pl. 35 A.* VI. *f. 12.* 1854, and Schmidt, Atlas *pl. 43. f. 31–33.* 1876.

[e] De Toni, Syll. Alg. **2**: 9. 1891.

[f] Atlas *pl. 42. f. 3.* 1876.

As Ralfs[a] points out, this is too wide of *N. smithii* to make a variety, as Gregory proposed. I do not think it necessary to include here *N. serrulata* Schmidt,[b] as is done by Cleve. Schmidt himself points out that they are related, but they seem to me, as to him, worthy of separation.

Found at station 3696, off Honshu Island, Japan.

Navicula notabilis Grev. Trans. Micr. Soc. Lond. n. s. **11**: 18. *pl. 1. f. 9.* 1863. Moeb. Diat.-taf. *pl. 49. f. 9.* 1890. De Toni, Syll. Alg. **2**: 192. 1891. Schmidt, Jahresb. Komm. Deut. Meere **2**: 88. *pl. 1. f. 20, pl. 2. f. 11.* 1874. Schmidt, Atlas *pl. 8. f. 46–52.* 1875. Van Heur. Treat. Diat. 200. *pl. 26. f. 750–751.* 1896.

Diploneis notabilis Cleve, Sv. Vet. Akad. Handl. **26²**: 93. 1894.

My specimen agrees with the two figures of Schmidt,[c] *N. notabilis expleta*, which make so divergent a variety that it would almost be allowable to raise the form to specific rank instead of considering it a variety of the above species.

Found at station 2808, Galapagos Islands.

Navicula oamaruensis Grun.; Schmidt, Atlas *pl. 129. f. 9.* 1888. Cleve, Sv. Vet. Akad. Handl. **27³**: 57. 1895.

It is a question if this can be maintained as a separate species from *N. praetexta* Ehrenb. It is so close to *N. haytiana* Truan & Witt,[d] that the only point of contrast is in the latter having the marginal striae interrupted at the terminations of the raphe, while the above has the striae unbroken around the entire valve. The close resemblance is noted by Grunow in the above citation. Cleve unites *N. haytiana* with *N. praetexta*, yet gives this separate rank. I can only say in conforming to this rather inconsistent arrangement that the line has to be drawn somewhere. It is significant that the following dredging which furnishes this form also furnishes the normal *N. praetexta* and the typical *N. haytiana*, as will be noted under *N. praetexta*.

Found at station 2807, Galapagos Islands.

Navicula pennata Schmidt, Atlas *pl. 48. f. 41–43.* 1876. De Toni, Syll. Alg. **2**: 113. 1891. Cleve, Sv. Vet. Akad. Handl. **27³**: 32. 1895.

Navicula kinkeri Pant. Beitr. Bacill. Ung. **2**: 50. *pl. 9. f. 169.* 1889. De Toni, Syll. Alg. **2**: 21. 1891.

Scoliopleura szakalensis Pant. Beitr. Bacill. Ung. **2**: 57. *pl. 8. f. 154.* 1889. De Toni, Syll. Alg. **2**: 267. 1891.

Navicula pinnata Pant. Beitr. Bacill. Ung. **2**: 54. *pl. 20. f. 308.* 1889. Cleve, Sv. Vet. Akad. Handl. **27³**: 33. 1895. De Toni, Syll. Alg. **2**: 64. 1891.

Leaving out the unimportant matter of size, this species differs from *N. longa* Greg. chiefly in its tapering and transversely cut striae. I see no reason to consider any of the above forms of Pantocsek as different from this species. Cleve unites the first two here, but assigns inconsequent reasons for giving *N. pinnata* separate standing. *Scoliopleura szakalensis* is merely a contorted specimen of *N. kinkeri;* both come from the same fossil deposit at Szakal. *N. pinnata*, though not recorded by Pantocsek from Szakal, is of wide distribution, occurring with *N. kinkeri* and *S. szakalensis* at Nagy-Kurtos, as well as at Bory and Bremia. The union of *N. pinnata* here happens to have the added advantage of making synonymous a name too easily confused with that given by Schmidt.

Found at station 4516H, Gulf of California.

Navicula phoenicenteron (Nitzsch) Ehrenb. Ber. Akad. Wiss. Berl. **1836**: 53. 1837; Infus. 175. *pl. 13. f. 1.* 1838.

Bacillaria phoenicenteron Nitzsch. Neue Schrift. Naturf. Ges. Halle **3**: *pl. 3. f. 12, 14* (exclusive of other figures). 1817. Ehrenb. Infus. 175. 1838.

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[a] Pritch. Hist. Infus. ed. 4. 893. 1861.

[b] Schmidt, Atlas *pl. 7. f. 42–43.* 1875.

[c] Opp. cit. *pl. 8. f. 49–50.*

[d] Truan & Witt, Diat. Hayti *pl. 4. f. 9.* 1888.

Cymbella phoenicenteron Ag. Consp. Diat. 10. 1832.

Stauroneis lanceolata Kütz. Bacill. 104. *pl. 30. f. 24.* 1844. Grun. Verh. Zool. Bot. Ges. Wien **10**: 563. 1860. Pritch. Hist. Infus. ed. 4. 913. 1861. Rabh. Susw. Diat. 48. *pl. 9. f. 9.* 1853.

Stauroneis phoenicenteron Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 387. *pl. 2. V. f. 1, pl. 3. I. f. 17.* 1843; Mikrog. *pl. 2. II. f. 8, pl. 3. I. f. 7. II. f. 4, pl. 6. I. f. 21, pl. 9. I. f. 15, pl. 15. I. A. f. 27. B. f. 10, pl. 16. I. f. 5. II. f. 5, III. f. 28.* 1854 (not Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1870**: *pl. 2. I. f. 29, pl. 3. I. f. 21.* 1871). Rabh. Susw. Diat. 47. *pl. 9. f. 1.* 1853. W. Smith, Synop. Brit. Diat. **1**: 59. *pl. 19. f. 185.* 1853. Pritch. Hist. Infus. ed. 4. 913. *pl. 9. f. 139, pl. 12. f. 17–18.* 1861. Brun, Diat. Alp. 88. *pl. 9. f. 5, 7.* 1880. Griff. & Henf. Micr. Dict. ed. 4. 735. *pl. 15. f. 43.* 1883. Van Heur. Synop. 67. *pl. 4. f. 2.* 1881; Treat. Diat. 158. *f. 30,* 159. *pl. 1. f. 50.* 1896. De Toni, Syll. Alg. **2**: 204. 1891. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 148. 1894. H. L. Smith, Sp. Diat. Typ. no. 496. 1874. Belloc, Rev. de Comm. **3**: 40. *pl. 3. f. 11.* 1887. Not Kütz.

Stauroneis baileyi Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 422. 1843; Mikrog. *pl. 2. III. f. 12* (not *f. 10*), *pl. 3. III. f. 6–7. IV. f. 11, pl. 4. I. f. 4. II. f. 11–12. III. f. 2, pl. 5. I. f. 13. III. f. 14, pl. 6. I. f. 17.* 1854. Kütz. Bacill. 105. 1844. Pritch. Hist. Infus. ed. 4. 913. 1861. De Toni, Syll. Alg. **2**: 207. 1891.

Stauroneis pteroidea Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 423. 1843; Mikrog. *pl. 14. I. f. 5.* 1854. Kütz. Bacill. 105. 1844. De Toni, Syll. Alg. **2**: 207. 1891.

Stauroneis amphilepta Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 386. *pl. 1. II. f. 9, 13.* 1843; Mikrog. *pl. 14. f. 18.* 1854. Kütz. Bacill. 105. *pl. 29. f. 16–17.* 1844. Pritch. Hist. Infus. ed. 4. 913. 1861.

Stauroneis brunii Perty; Herib. Diat. Auverg. 76. *pl. 3. f. 22.* 1893.

Cleve leaves out the two first-named synonyms and consequently credits the name to Ehrenberg. I am dependent for the reference upon the accuracy of Ehrenberg's citation,[a] but as it is about universally conceded to be correct I quote the reference to Nitzsch without having seen the original publication.

I do not favor placing *Stauroneis gracilis* Ehrenb. in this list. Ehrenberg's original figures[b] represent a diatom sharper, much smaller, and much more delicate. The same is true of Smith's figures,[c] though this fails to agree with the Ehrenberg type because of its narrower stauros.

The question of the union of Stauroneis with the present genus has been discussed under Navicula above.

Found at station 2882, off Oregon.

Navicula pinguis Mann, sp. nov. PLATE LIII, FIGURE 5.

Valve broad, slightly narrowed at the center; ends blunt, center depressed; markings of heavy ridges bearing large oval beads, three to four, the outer row being elongated to the margin; a longitudinal hyaline area, through which runs the raphe, connecting the apices and bordered on either side by a single row of large oval beads of the same number as and continuous with the ridges.

Length of valve, 0.160 mm.; width of valve, 0.070 mm. Striae, 28 in 0.1 mm.

This species bears considerable resemblance to Grunow's figure of *N. subcincta* Schmidt,[d] and were this identification correct I would not hesitate to write this as a wide variety of that species. But Grunow's form is in no sense Schmidt's diatom. Aside from a general similarity of outline and of the median line area, they are most strongly contrasted. Not only does it fail to agree in beading and the direction of the striae, especially at the center, with the figure in the Atlas quoted by Grunow,[a] but if we take Schmidt's original type form[b] the difference is even more pronounced. Grunow also includes what Lagerstedt has perhaps erroneously called *N. didyma* (Ehrenb.) Kütz.[c] This form, the author says in a note, is close to one of Donkin's figures of *N. didyma.*[d] But without going into the merits of Lagerstedt's identification it is enough to say that it has little if any resemblance to either Schmidt's *subcincta* or to my species, and that *subcincta* is far closer to Donkin's figure of *didyma* than the one given by Lagerstedt, a fact noted under *N. subcincta* in this report. The exact type form of Schmidt's *N. subcincta* occurs at station 3008H, corresponding with it in form, markings, and size. When it is compared with this species, all true resemblance vanishes. It may be instructive to add here the measurements of Grunow's and Schmidt's specimens for comparison with those given above. Length of Grunow's largest specimen, 0.107 mm.; smallest, 0.062 mm; of Schmidt's type, *N. subcincta*, 0.054 mm.

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[a] Ehrenb. Infus. 175. 1838.

[b] Phys. Abh. Akad. Wiss. Berl. **1841**: 386. *pl. 1. II. f. 14, pl. 2. I. f. 17.* 1843; Microg. *pl. 2. I. f. 2.* 1854.

[c] W. Smith, Synop. Brit. Diat. **1**: 59. *pl. 19. f. 186.* 1853.

[d] Denkschr. Akad. Wien **48**^{2}: 56. *pl. 1. f. 39.* 1884.

Type in the U. S. National Museum, No. 590148, from station 3604, Bering Sea, August 12, 1895; 1,401 fathoms, bottom of green ooze.

Navicula pleurostaurum Mann.

Stauroneis acuta W. S. Smith, Synop. Brit. Diat. **1**: 59. *pl.* 19. *f. 187*, front. *f. 187*. 1853. Pritch. Hist. Infus. ed. 4. 914. *pl. 7. f. 76.* 1861. Van Heur. Synop. 68. *pl. 4. f. 3.* 1881; Treat. Diat. 159. *pl. 1. f. 51.* 1896. Grun. Denkschr. Akad. Wien **48**^{2}: 47. 1884. H. L. Smith, Sp. Diat. Typ. no. 485. 1874. Wolle, Diat. N. A. *pl. 8. f. 11.* 1890. Schmidt, Atlas *pl. 141. f. 4–5.* 1889. Deby, Ann. Soc. Malacol. Belg. **11**: 88. 1876. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 150. 1894.

Pleurostaurum acutum Rabh. Hedwigia **1**: 17. *pl. 1. f. B.* 1859. Jan. in Hedwigia **1**: 25. 1859; **5**: *pl. 3. f. 1–8.* 1863. Rabh. Fl. Eur. Alg. **1**: 20. 259. *f. 6.* 1864.

Pleurostauron acutum Rabh.; De Toni, Syll. Alg. **2**: 222. 1891.

Stauroneis kochii Pant. Beitr. Bacill. Ung. **3**: *pl. 6. f. 93.* 1893.

As I find it necessary to discard the genus Stauroneis as separate from Navicula for reasons already given, I am compelled to give a new specific name to this well-known diatom. The name *N. acuta* is preempted by *N. acuta* Kütz., an indeterminate form,[e] as well as *N. acuta* (W. Smith) O'Meara.[f]
The synonymous form *Stauroneis kochii* Pant. can not be used, as there is a *N. kochii* Pant.[g] I therefore apply to this diatom the specific name *pleurostaurum*, taking the lapsed generic name of Rabenhorst,[h] of which this particular diatom was the type. As Rabenhorst has pointed out, this diatom is peculiar in the sunken stauros as well as in the internal thickening of the side margins, especially toward the ends, which give a thickened, hooded aspect to the apices. De Toni and others accept this as an adequate generic distinction. I do not consider this and similar forms, as *N.* (*Stauroneis*) *fulmen* Bright., to be sufficiently distinct from other examples of Navicula to require their separation. Cleve,[i] while retaining this in Stauroneis, makes use of Pleuro-

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[a] Schmidt, Atlas *pl. 13. f. 41.* 1875.

[b] Jahresb. Komm. Deut. Meere **2**: *pl. 2. f.* 7. 1874.

[c] Bih. Sv. Vet. Akad. Handl. **3**^{15}: 36. *pl. 1. f. 4.* 1876.

[d] Donk. Brit. Diat. *pl.* 7. *f. 8b.* 1871–73.

[e] Kütz. Bacill. 93. *pl. 3. f. 69.* 1844.

[f] Proc. Roy. Irish Acad. II. **2**: 407. *pl. 34. f. 5. 1875.*

[g] Pant. Beitr. Bacill. Ung. **2**: 49. *pl. 4. f. 72.* 1889.

[h] Hedwigia **1**: 17. 1859.

[i] Sv. Vet. Akad. Handl. **26**^{2}: 150. 1894.

stauron as a subgeneric distinction. As such it is to be commended, though I think Cleve is here inconsistent, as Pleurostaurum (original spelling) is as different from his Stauroneis as it is from Navicula.

Found at station 3635H, Bering Sea.

Navicula praetexta Ehrenb. Ber. Akad. Wiss. Berl. **1840:** 214. 1841. Greg. Trans. Roy. Soc. Edinb. **21:** 481. *pl. 1. f. 11.* 1857. Kütz. Bacill. 98. 1844. Donk. Brit. Diat. 10. *pl. 2. f. 1.* 1871–73. O'Meara, Proc. Roy. Irish Acad. II. **2:** 387. *pl. 32. f. 27.* 1875. Schmidt, Atlas *pl. 3. f. 30–34.* 1875; *pl. 129. f. 7–8.* 1888. Van Heur. Synop. 92. *pl. 9. f. 13.* 1881–85; Treat. Diat. 204. *pl. 4. f. 159.* 1896. Rabh. Fl. Eur. Alg. **1:** 183. 1864. Pritch. Hist. Infus. ed. 4. 898. 1861. Witt, Verh. Russ. Min. Ges. II. **22:** 165. *pl. 9. f. 4.* 1886. Pant. Beitr. Bacill. Ung. **1:** 30. *pl. 9. f. 79.* 1886. Truan, Anal. Soc. Espan. Hist. Nat. **13:** 44. *pl. 8. f. 27.* 1884. Cleve, Sv. Vet. Akad. Handl. **27^3:** 55. 1895. De Toni, Syll. Alg. **2:** 102. 1891. Wolle, Diat. N. A. *pl. 20. f. 1, 7* (not *pl. 111. f. 3*). 1890. Truan & Witt, Diat. Hayti 17. *pl. 4. f. 8.* 1888.

Pinnularia praetexta Ehrenb. Mikrog. *pl. 19. f. 28.* 1854.

Navicula lunyacsekii Pant. Beitr. Bacill. Ung. **1:** 28. *pl. 14. f. 122.* 1886?

Navicula haytiana Truan & Witt, Diat. Hayti *pl. 4. f. 9.* 1888.

Navicula reticulo-radiata Temp. & Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **30^2:** 44. *pl. 5. f. 4.* 1889. Schmidt, Atlas *pl. 204. f. 18.* 1897. Cleve, Sv. Vet. Akad. Handl. **27^3:** 55. 1895.

It is somewhat of a stretch to include here the above-named synonym of Pantocsek's; but the very suggestive figure cited above by Truan & Witt is so evident a comment on the validity of Pantocsek's species that I follow Cleve in joining them. I think that with almost equal reason another figure on the same plate,[a] called *N. neupauerii* Pant., could be classed here. De Toni[b] and Cleve[c] include *N. haytiana*, as above. Three reasons are given by the authors for holding it separate from *N. praetexta*. The best answer to these is found in comparing their own figures of the two species on plate 4, figures 8 to 9. This particular form, *haytiana*, is found at station 2807 in company with the true type.

Found at stations 2807, 2920H, Galapagos and Hawaiian islands.

Navicula prodiga Mann, sp. nov. PLATE LIII, FIGURE 4.

Valve outline of 6 perfectly straight lines forming an elongated hexagon, the apices alone being rounded; the two median sides shorter than those running to the apices; markings of moniliform striae arranged in the general lyrate pattern, the striae of large rounded beads, the actually median striae alone being transverse, those on either side of the middle curving and becoming concentric to the two apices; interspaces between the striae one-half the width of a bead; lyrate hyaline area narrow, its ends not approaching, hence the beaded rows on each side of the raphe of nearly equal width from center to apices; marginal striae at the middle of the valve fully two-fifths its width, thence diminishing toward the apices as the sides approach; valve surface just within the margin all around depressed, whereas the margin itself is slightly elevated above the rest of the surface, thus producing the appearance of a border.

Length of valve, 0.150 mm.; width of valve, 0.085 mm.; striae, 48 in 0.1 mm.

The hexagonal form called *N. hennedyi cuneata* Schmidt[d] resembles my species only in its hexagonal outline. A far nearer form in Janisch's Diatoms of the Gazelle Expedition, plate 15, figure 23, is named *N. lyra elliptica* Schmidt by Cleve,[e] where it is joined with figures in Van Heurck's Synopsis, plate 10, figure 2, Schmidt's Nordsee

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[a] Pant. Beitr. Bacill. Ung. **1:** *pl. 14. f. 123.* 1886.

[b] De Toni, Syll. Alg. **2:** 103. 1891.

[c] Sv. Vet. Akad. Handl. **27^3:** 55. 1895.

[d] Schmidt, Atlas *pl. 3. f. 4.* 1875.

[e] Sv. Vet. Akad. Handl. **27^3:** 63. 1895.

Diatomaceen,[a] plate 1, figure 39, and Schmidt's Atlas, plate 2, figure 29. It also has considerable resemblance to Schmidt's Atlas, plate 2, figure 10, *N. kittoniana* Schmidt, which Cleve[b] makes a variety of *N. approximata* Grev.; though how he can see *N. approximata* in that form and *N. lyra* in the form figured by Janisch just mentioned is beyond my understanding. Whether or not the form represented by Janisch's figure, the *N. kittoniana* of Schmidt, and my specimen should be classed as a variety of *N. lyra* is a question of the limits of a species and the degree of dissimilarity it is desirable to include under one name. Taking the view that it is advantageous to add as few new forms as possible to the already enormous species *N. lyra*, I have given the above name. For reasons mentioned in the introduction, the naming of varieties is not favored by the writer. It may be noted that my specimen differs in several respects from the two I have here associated with it, especially in the H-shaped hyaline space not having its tips approach, but strictly parallel, whereby the central rows of striae are of the same width from the apices to the center. But the minor differences between my form and that of Janisch's above can not make them two species.

Type in the U. S. National Museum, No. 590149, from station 2920H, Hawaiian Islands, November 21, 1891; 570 fathoms, bottom of brown mud and fine sand.

Navicula sandriana Grun. Verh. Zool. Bot. Ges. Wien **13**: 153. *pl. 13. f. 5.* 1863. Schmidt, Atlas *pl. 3. f. 10.* 1875; *pl. 70. f. 45.* 1881. O'Meara, Proc. Roy. Irish Acad. II. **2**: 388. *pl. 32. f. 29.* 1875 (figure poor). Lagers. Bih. Sv. Vet. Akad. Handl. **3^{15}**: 41. 1876. De Toni, Syll. Alg. **2**: 105. 1891. Cleve, Sv. Vet. Akad. Handl. **27^{3}**: 59. 1895.

Navicula rimosa Grev. Trans. Micr. Soc. Lond. n. s. **14**: 129. *pl. 12. f. 25.* 1866. Moeb. Diat.-taf. *pl. 75. f. 25.* 1890.

It seems to me the original figures of both the above give emphasis to a rather inconstant feature of this diatom, namely, the narrow sickle-shaped line of striae midway between the center and the margin. This is very liable to be reduced to a somewhat indefinite granulation blending with the more indistinct granulation about it. In fact, there are unmistakable varieties in which these sickle-shaped lines can virtually disappear. In such a case we are confronted by the question in what respect such a form is separable from varieties of *N. kennedyi* and *N. praetexta*, nor can we find any satisfactory answer. In other words, however useful for classification it undoubtedly is to retain the enumerated names to designate the more diverse of these forms, it is probable that both *N. sandriana* and *N. kennedyi* will eventually be considered only striking variations of *N. praetexta*.

Found at station 4516H, Gulf of California.

Navicula silicula Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 419. 1843; Mikrog. *pl. 6. I. f. 16, pl. 10. I. f. 13, pl. 14. f. 22, pl. 15A. f. 37a–b.* 1854. Pritch. Hist. Infus. ed. 4. 894. 1861.

Navicula limosa Kütz. Bacill. 101. *pl. 3. f. 50.* 1844. Grun. Verh. Zool. Bot. Ges. Wien **10**: 544. *pl. 3. f. 8a–c, 10* (not *f. 7, 8d–e, 9*). 1860. Donk. Quart. Journ. Micr. Sci. n. s. **9**: 294. *pl. 18. f. 7.* 1869. Moeb. Diat.-taf. *pl. 79. f. 7.* 1890. Donk. Brit. Diat. 73. *pl. 12. f. 6.* 1871–73. Brun, Diat. Alp. 73. *pl. 7. f. 12.* 1880 Van Heur. Synop. 103. *pl. 12. f. 18–20, 22–23.* 1881; Treat. Diat. 219. *pl. 5. f. 207–208.* 1896. Lagers. Bih. Sv. Vet. Akad. Handl. **1^{14}**: 31. *pl. 1. f. 6, 7a.* 1873. Rabh. Sussw. Diat. 41. *pl. 6. f. 31.* 1853. Pritch. Hist. Infus. ed. 4. 894. 1861. De Toni, Syll. Alg. **2**: 147. 1891.

Navicula silicula Grun.; Van Heur. Synop. *pl. 12. f. 21.* 1881.

Caloneis silicula Cleve, Sv. Vet. Akad. Handl. **26^{2}**: 51. 1894.

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[a] Jahresb. Komm. Deut. Meere **2**: *pl. 1. f. 39.* 1874.

[b] Loc. cit.

Navicula gibberula Kütz. Bacill. 101. *pl. 3. f. 50.* 1844. W. Smith, Synop. Brit. Diat. 1: *pl. 17. f. 160.* 1853. Lagers. Bih. Sv. Vet. Akad. Handl. 1^{14}: 31. *pl. 1. f. 7.* 1873. De Toni, Syll. Alg. **2**: 148. 1891.

Navicula ventricosa Ehrenb. err. det. Donk. Brit. Diat. 74. *pl. 12. f. 7.* 1871-73. Van Heur. Synop. 103. *pl. 12. f. 24-26.* 1881; Treat. Diat. 220. *pl. 5. f. 209.* 1896. Cleve & Grun. Sv. Vet. Akad. Handl. **17**^{2}: 29. *pl. 1. f. 16-18.* 1880. De Toni, Syll. Alg. **2**: 148. 1891. Cleve in Nordensk. Vega Exped. **3**: 464. 1883.

Navicula subventricosa Grun.; Cleve & Grun. Sv. Vet. Akad. Handl. **17**^{2}: 29. *pl. 1. f. 19.* 1880. De Toni, Syll. Alg. **2**: 150. 1891. Cleve in Nordensk. Vega Exped. **3**: 464. 1883.

Navicula horvathii Grun. Verh. Zool. Bot. Ges. Wien **10**: *pl. 6. f. 18.* 1860.

Navicula haslinszkyi Pant. Beitr. Bacill. Ung. **2**: 48. *pl. 11. f. 193.* 1889.

Navicula neogena Pant. Beitr. Bacill. Ung. **3**: *pl. 17. f. 252, pl. 25. f. 372.* 1893.

There is some doubt of the propriety of including here *N. ventricosa*, especially if we take into consideration Ehrenberg's authorship. It should either be left out of this category or referred to as *N. ventricosa* Ehrenb. err. det. Donk. as above. The contrast is considerable even in that case, because of the striking stauros. But if we take into consideration *N. haslinszkyi* (see above), we find a perfect gradation from one phase to the other. Donkin has included here several species that have absolutely nothing in common with this species except the trinodal outline; thus, *N. leptogongyla* Ehrenb.[a] O'Meara offers such absurd figures of this diatom[b] that they are much worse than none.

Found at station 3696, off Honshu Island, Japan.

Navicula smithii Breb.; W. Smith, Synop. Brit. Diat. **2**: 92. 1856. Grun. Verh. Zool. Bot. Ges. Wien **10**: 531. 1860; Denkschr. Akad. Wien **48**^{2}: 56. *pl. 1. f. 40-41.* 1884; in Fenzl, Reise Novara Bot. **1**: 18. 1870. Schmidt, Jahresb. Komm. Deut. Meere **12**: *pl. 1. f. 19.* 1874; Atlas *pl. 7. f. 14-20* (*f. 21-22* doubtful). 1875. Rabh. Fl. Eur. Alg. **1**: 178. 1864. Donk. Brit. Diat. 6. *pl. 1. f. 40.* 1871-73. O'Meara, Proc. Roy. Irish Acad. II. **2**: 382. *pl. 32. f. 18.* 1875. Van Heur. Synop. 91. *pl. 9. f. 12;* Suppl. *pl. B. f. 23.* 1881-85; Treat. Diat. 197. *pl. 4. f. 151.* 1896. Pant. Beitr. Bacill. Ung. **2**: 55. 1889. Truan, Anal. Soc. Espan. Hist. Nat. **13**: 45. *pl. 8. f. 25-26.* 1884. Petit, Journ. Roy. Micr. Soc. **1**: 245. *pl. 14. f. 14.* 1878. De Toni, Syll. Alg. **2**: 86. 1891 (not *N. smithii* (C. Ag.). Van Heur. Treat. Diat. 231. 1896). Wolle, Diat. N. A. *pl. 12. f. 11, pl. 14. f. 12* (not *pl. 20. f. 8*). 1890.

Diploneis smithii (Breb.) Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 96. 1894.

Navicula elliptica W. Smith, Synop. Brit. Diat. **1**: 48. *pl. 17. f. 152a* (not *f. 152a**). 1853 (not Kütz. 1844).

Navicula doczyi Pant. Beitr. Bacill. Ung. **2**: 45. *pl. 14. f. 247.* 1889.

De Toni here includes *Pinnularia scutellum* O'Meara,[c] which is *Navicula scutellum* O'Meara.[d] This is a gross error. O'Meara's form, judged by its figures and descriptions, is a truly costate-ribbed diatom which shows none of the double-rowed beading so characteristic of *N. smithii*. I think if such were present, it could not have been twice overlooked by O'Meara. Cleve[e] questions Van Heurck's determination of *N. scutellum* O'Meara,[f] referring the figure doubtfully to *N. smithii* Breb. It is something like *N. smithii*, but in the absence of the beading I think it is a poor figure of O'Meara's species. Van Heurck[g] has transferred *Schizonema smithii* C. Ag. to *Navi-*

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[a] Ehrenb. Mikrog. *pl. 10. I. f. 11, pl. 16. I. f. 10. II. f. 7. III. f. 22.* 1854.

[b] Proc. Roy. Irish Acad. II. **2**: *pl. 31. f. 30-31.* 1875.

[c] Quart. Journ. Micr. Sci. n. s. **9**: 151. *pl. 12. f. 5.* 1869.

[d] Proc. Roy. Irish Acad. II. **2**: 396. *pl. 33. f. 14.* 1875.

[e] Sv. Vet. Akad. Handl. **26**^{2}: 96. 1894.

[f] Van Heur. Synop. *pl. 9. f. 11.* 1881.

[g] Van Heur. Treat. Diat. 231. *pl. 5. f. 241.* 1896.

cula smithii (C. Ag.) Van Heur., and refers to his former figures.[a] Undoubtedly the figures given by Van Heurck are a Navicula, and undoubtedly all such forms should be changed from Schizonema to Navicula. Were this, therefore, a justifiable identification, *N. smithii* Breb. would have to give way to *N. smithii* (C. Ag.) Van Heur., as *Schizonema smithii* C. Ag. was published in 1824.[b] There are two early representations of *S. smithii* C. Ag.[c] In the earlier there is no mention of the markings of the valve, the description being concerned with the shape of the gelatinous threads inclosing the frustules, as is common in Kützing. The figures are too small to give any clear idea of the valve. Enough, however, is evident to show that Kützing's idea of this species of Agardh is irreconcilable with that of William Smith. Smith's figure is clear and the description accurate, yet the author quotes Kützing's entirely discordant figure. Van Heurck's figures are different from both the foregoing, and he says[d] of this form, "nec Kütz., Smith, &c.," and on figure 4 of the same plate he refers both the figure in Kützing and that in Smith to *S. ramosissimum* C. Ag. De Toni[e] recognizes Van Heurck's idea of *S. smithii* C. Ag. to be correct, while Cleve[f] makes it a synonym of *Navicula avenacea* Breb. I think there can be no doubt that the *S. smithii* C. Ag. of Smith's Synopsis[g] is the same as *S. ramosissimum* C. Ag. as that form is interpreted by Van Heurck, Cleve, and others. I could extend indefinitely the recital of this muddle over *S. smithii* C. Ag. were it worth while. Enough has been said to illustrate the fact I now wish to mention, namely, that in dealing with members of the old genus Schizonema we are as a rule confronted with indefinable names, impossible to include in our synonymy, if we wish to be at all accurate as to facts. This arises from the custom in the earlier books of laying stress on the gelatinous envelope to the partial or complete neglect of the diatoms inclosed, so that the species and in many cases the genus of the original form is absolutely obscured. Here and there we find a case where a name, originally indefinable, becomes in subsequent works repeated and more clearly imaged, and grows to be widely accepted as standing for a diatom of well-marked and generally understood characteristics. In such cases it is perhaps well to refer to the original citation and include it in the synonymy. But *S. smithii* C. Ag. is an example of a host of forms with no such history. Nobody knows what Agardh meant by his name. There is no agreement among the various authors as to its structure. We can not even know that it was a Navicula. To take what, practically speaking, is a nomen nudum, and transfer it to Navicula on the basis of mere guesswork, thereby invalidating a long-established and thoroughly understood name, is manifestly not justifiable, for it destroys a valid name for an indefinable one.

Found at stations 2920H, 3696, 3712H, Hawaiian Islands, Honshu Island, and Okhotsk Sea.

Navicula solaris Greg. Trans. Micr. Soc. Lond. n. s. **4**: 43. *pl. 5. f. 10.* 1856. Moeb. Diat.-taf. *pl. 10. f. 10.* 1890. Schmidt, Atlas *pl. 46. f. 16.* 1876. Rabh. Fl. Eur. Alg. **1**: 181. 1864. O'Meara, Proc. Roy. Irish Acad. II. **2**: 410. *pl. 34. f. 13.* 1875 (poor figure). Pritch. Hist. Infus. ed. 4. 904. 1861. Cleve, Sv. Vet. Akad. Handl. **27**^{3}: 32. 1895. De Toni, Syll. Alg. **2**: 53. 1891.

Schmidt's doubt of his figure, quoted above, being *N. solaris* was shown to be unnecessary by a complete frustule I found in the dredging at station 3607, in which one valve corresponded exactly to his figure and the other showed the sun-like rays around the center, referred to in the specific name. I find a minute error in focusing intensifies this "solar" effect, which must be the method by which such greatly exaggerated representations as that by O'Meara were obtained.

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[a] Van Heur. Synop. *pl. 15. f. 33.* 1881; Treat. Diat, *pl. 5. f. 241.* 1896.

[b] C. Ag. Syst. Alg. 10. 1824.

[c] Kütz. Bacill. 114. *pl. 27. f. 5.* 1844. W. Smith, Synop. Brit. Diat. **2**: 75. *pl. 57. f. 362.* 1856.

[d] Van Heur. Synop. *pl. 15. f. 33.* 1881.

[e] Syll. Alg. **2**: 293. 1891.

[f] Sv. Vet. Akad. Handl. **27**^{3}: 15. 1895.

[g] W. Smith, Synop. Brit. Diat. **2**: 75. 1856.

Found at stations 3607, 3611, Bering Sea.

Navicula speciosa Mann, sp. nov. PLATE LII, FIGURE 5.

Valve deeply constricted at the middle; the two halves broadest just beyond this constriction; thence narrowing rapidly to the blunt, rounded apices; striae moniliform, except at the constriction, where they are fused into three ridges; beads large, oval, the marginal ones double the length of the others; striae toward the middle of the valve oblique to the raphe,,but not curved, toward the apices becoming curved; a single row of large beads on either side of the median line; ends of the raphe at the center separated by a small hyaline round area, the central nodule.

Length of valve, 0.12 mm.; width of valve, 0.045 mm., and at the middle, 0.012 mm.

Type in the U. S. National Museum, No. 590150, from station 2807, Galapagos Islands, April 4, 1888; 812 fathoms, bottom of Globigerina ooze and coral mud.

Navicula spectabilis Greg. Trans. Roy. Soc. Edinb. **21**: 481. *pl. 9. f. 10.* 1857. Rabh. Fl. Eur. Alg. **1**: 178. 1864. Schmidt, Atlas *pl. 2. f. 31*, *pl. 3. f. 20–21*, *29*. 1875. Donk. Brit. Diat. 12. *pl. 2. f. 5.* 1871–73. Cleve, Sv. Vet. Akad. Handl. **27^{3}**: 60. 1895. Castr. Rep. Voy. Chall. Bot. **2**: 32. *pl. 28. f. 9.* 1886. De Toni, Syll. Alg. **2**: 98. 1891. Pritch. Hist. Infus. ed. 4. 898. 1861. O'Meara, Proc. Roy. Irish Acad. II. **2**: 390. 1875. Van Heur. Treat. Diat. 202. *pl. 27. f. 757.* 1896 (not *N. spectabilis* Grun. Verh. Zool. Bot. Ges. Wien **10**: 533. *pl. 1. f. 11.* 1860).

Navicula excavata Grev. variety; Schmidt, Atlas *pl. 3. f. 22–25.* 1875 (not *N. excavata* Grev.). Jan. Diat. Gaz. Exped. *pl. 15. f. 22.* Cleve, Sv. Vet. Akad. Handl. **18^{5}**: 8. *pl. 2. f. 20.* 1881 (not Schmidt, Atlas *pl. 70. f. 46.* 1881, according to Grun.).

Navicula mikado Pant. Beitr. Bacill. Ung. **3**: *pl. 23. f. 334.* 1893.

Although the figures above cited of *N. excavata* Grev. variety are clearly synonyms of this species, I do not think the original form of Greville's diatom,[a] nor the figure so named by Grunow,[b] can safely be looked upon as the same. Beyond question *N. o'swaldii* Jan.[c] is the same as Greville's species, as Grunow points out.[b] But when we compare any of these figures of *N. excavata* which are in harmony with the original with the type of *N. spectabilis* as given by Gregory or in the superb figure by Donkin, it is plainly too wide a stretch to cover both forms by one specific name. As Cleve says, this species merges toward *N. lyra* Ehrenb., on the one hand, and *N. hennedyi* W. Smith, on the other; but if it is to be a species at all and have any boundaries, it can not include Greville's diatom. Nor is Cleve correct in adding to the above synonymy *N. bullata* Norm.[d] and *N. rattrayi* Pant.[e] If we wish to see the result of this over condensation on the part of Cleve, we can not do better than compare figures 46 and 52 in plate 70 of Schmidt's Atlas, both of which he ranges under *N. spectabilis*. Such a "species" is out of all bounds and not worth retaining.

Found at stations 2807, 2920H, Galapagos and Hawaiian islands.

Navicula splendida Greg. Trans. Micr. Soc. Lond. n. s. **4**: 44. *pl. 5. f. 14.* 1856. Pritch. Hist. Infus. ed. 4. 893. Schmidt, Jahresb. Komm. Deut. Meere **2**: 85. *pl. 1. f. 3–4*; *pl. 2. f. 2.* 1874; Atlas *pl. 13. f. 31–34.* 1875; *pl. 69. f. 22.* 1881. Van. Heur. Synop.

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[a] Trans. Micr. Soc. Lond. n. s. **14**: 130. *pl. 12. f. 15.* 1866.

[b] Schmidt, Atlas *pl. 70. f. 46.* 1881.

[c] Schmidt, Atlas *pl. 70. f. 46.* 1881. Jan. Diat. Gaz. Exped. *pl. 15. f. 12.* Pant. Beitr. Bacill. Ung. **2**: 52. *pl. 25. f. 370.* 1889.

[d] Castr. Rep. Voy. Chall. Bot. **2**: 29. *pl. 28. f. 10.* 1886. Schmidt, Atlas *pl. 70. f. 51–52.* 1881.

[e] Pant. Beitr. Bacill. Ung. **2**: 52. *pl. 30. f. 427.* 1889.

pl. 9. f. 4. 1881; Treat. Diat. 193. *pl. 26. f. 729.* 1896. O'Meara, Proc. Roy. Irish Acad. II. **2:** 402. *pl. 33. f. 30* (poor). 1875. De Toni, Syll. Alg. **2:** 80. 1891.

Navicula entomon Ehrenb. err. det. Donk. Brit. Diat. 49. *pl. 7. f. 5.* 1871–73.

Navicula didyma Ehrenb. err. det. Greg. Trans. Micr. Soc. Lond. n. s. **4:** 45. *pl. 5. f. 16* (not *f. 15*). 1856.

Navicula gemmatula Grun. err. det. Cleve, Journ. Quek. Micr. Club II. **2:** 167. *pl. 12. f. 1.* 1885.

Diploneis splendida Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 87. 1894.

Donkin's placing this species under *N. entomon* Ehrenb. is not to be favored, as his figure is clearly a *N. splendida.* It is difficult to determine what *N. entomon* is, as Ehrenberg's figures[a] are not remotely alike; but certainly they can not be united with the above species. Rabenhorst[b] erroneously includes here *N. incurvata* Greg., an arrangement accepted by De Toni.[c] Cleve holds them separate, and also groups here quite a number of species that I do not consider synonymous. There is, however, one in his list,[d] namely *N. diplosticta* Grun.[e] which is close to this species, perhaps too close.[f] A specimen from station 3604 is unusually small and with very delicate beading, but built on the general plan of this species. See also remarks under *N. omaruensis* (Cleve) Mann Ehrenb. in this report.

Found at stations 2920H, 3008H, 3603, 3604, Hawaiian Islands and Bering Sea.

Navicula spuma Mann, sp. nov. PLATE LII, FIGURE 7.

Valve broadly elliptical, tapering by even curve to the rounded, somewhat produced apices; raphe perfectly straight, on either side of it a very narrow hyaline space, expanded at the center into a large circular hyaline area one-half the width of the valve; markings a fine shagreen, this near the margin all around the valve broken up into a row of foam-like flakes; margin delicately beaded.

Length of valve, 0.075 mm.; width of valve, 0.030 mm.

The general aspect of this diatom is that of a Mastogloia, but it entirely lacks the internal marginal plates or septa characteristic of that genus.

Type in the U. S. National Museum, No. 590151, from station 4029H, Bering Sea, June 27, 1900; 913 fathoms, bottom of grey sand and clay.

Navicula subacuta (Ehrenb.) Ralfs in Pritch. Hist. Infus. ed. 4. 908. 1861. Schmidt, Atlas *pl. 43. f. 31–33.* 1876. De Toni, Syll. Alg. **2:** 192.

Pinnularia subacuta Ehrenb. Mikrog. *pl. 35A, VI. f.* 12. 1854.

Pinnularia major Cleve. Sv. Vet. Akad. Handl. **27**^{3}: 89. 1895, not *Navicula major* Kütz. Bacill. 97. *pl. 4. f. 19, 21.* 1844.

Some of my specimens approach one of Schmidt's unnamed figures,[g] and therefore somewhat resemble Schmidt's figure of *N. formosa* Greg.,[h] though this present species and *N. formosa* are clearly distinct. Cleve's union of *N. subacuta* with *N. major* Kütz. is not wise. See under that species in this report.

Found at station 4029 H, Bering Sea.

Navicula subcincta Schmidt, Jahresb. Komm. Deut. Meere **2:** 87. *pl. 2. f.* 7. 1874. Schmidt, Atlas *pl. 13. f. 41.* 1875.

Navicula succincta Schmidt, Atlas *pl. 69. f. 32.* 1881. De Toni, Syll. Alg. **2:** 76. 1891.

Diploneis subcincta Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 86. 1894.

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[a] Phys. Abh. Akad. Wiss. Berl. **1841:** *pl. 1. I. f. 3–4.* 1843; Mikrog. *pl. 19. f. 30.* 1854.

[b] Rabh. Fl. Eur. Alg. **1:** 204. 1864.

[c] De Toni, Syll. Alg. **2:** 81. 1891.

[d] Sv. Vet. Akad. Handl. **26**^{2}: 87–88. 1894.

[e] Schmidt, Atlas *pl. 13. f. 25–30.* 1875.

[f] Cf. also Schmidt, Atlas *pl. 69. f. 22.* 1881; *pl. 174. f. 10.* 1892.

[g] Schmidt, Atlas *pl. 43. f. 29.* 1876.

[h] Schmidt, Atlas *pl. 50. f. 12.* 1877.

This is probably distinct from *N. didyma* (Ehrenb.) Kütz., though it closely approaches Donkin's figure of that species.[a] I look upon this resemblance as much more striking than that between the present species and *N. didyma* (Ehrenb.) Kütz.,[b] as suggested by Grunow.[c] Grunow's own figures of this species are a quite different thing, and agree more closely with the diatom I have named *N. pinguis;* see under this for fuller discussion. O'Meara[d] is careless in calling this *N. subcivita* on his plate, and his figure is inexcusably bad.

Found at station 3008H, Hawaiian Islands.

Navicula undata Mann. sp. nov. Plate LIII, figure 1.

Valve an elongated ellipse, with blunt apices, the sides scarcely curved until about half way between the center and the ends, thence the curvature more pronounced for a short distance, and finally the sides nearly straight to the broad and blunt apices; markings of coarse beading of the *N. aspera* type, but the beads round, not oval, arranged in oblique moniliform striae, the beads of which are so spaced as to give a marked wavy appearance to the valve; raphe obscurely beaded, especially toward the center, there each half slightly bent toward the same side of the valve; a broad median area on either side the raphe, extended at the center as a large stauros running from one side of the valve to the other; terminations of the raphe at the extreme apices of the valve surrounded by large hyaline circular areas, reaching over the curve of the apices to the border.

Length of valve, 0.080 mm; width of valve, 0.019 mm. Striae, 17 in 0.01 mm.

This very minute but robust diatom belongs to the *N. aspera* group, except for its coarse beads being round and its central hyaline band extending from one side to the other, like the stauros of the Stauroneis type. It is in marked contrast with any known form, the nearest species being *N. macraeana* Pant.,[e] which differs greatly in its apices, its delicate beading, its stauros, its raphe, etc.

Type in the U. S. National Museum, No. 590152, from station 3571H, Bering Sea, July 6, 1895; 696 fathoms, bottom of green mud and ooze.

Navicula vagabunda Brun; Schmidt, Atlas *pl. 174. f. 5.* 1892.

Diploneis vagabunda Cleve, Sv. Vet. Akad. Handl. **26^2**: 103. *pl. 2. f. 13, 15.* 1894.

This diatom is suggestively near that variety of *N. crabro* (Ehrenb.) Kütz., known as *N. pandura* Breb.

Found at station 2808, Galapagos Islands.

Navicula vidovichii Grun. Verh. Zool. Bot. Ges. Wien **13**: 150. *pl. 13. f. 4.* 1863. Plate LII, figure 3.

Navicula egyptica Grev. Trans. Micr. Soc. Lond. n. s. **14**: 127. *pl. 12. f. 16–17.* 1886. Moeb. Diat-taf. *pl. 75. f. 16–17.* 1890.

Navicula bartholomei Cleve; Schmidt, Atlas *pl. 160. f. 9.* 1890, not Cleve, Bih. Sv. Vet. Akad. Handl. **5^8**: 6. *pl. 1. f. 5.* 1878.

Navicula sectilis Schmidt; Pant. Beitr. Bacill. Ung. **2**: 55. *pl. 8. f. 152.* 1889?.

The above combination represents a clear and satisfactory specific concept. *N. egyptica* is exactly the same as *N. vidovichii;* the variety called by Schmidt *N. bartholomei* Cleve variety, differs merely in being more constricted at the center of the valve, and the variety called by Pantocsek *N. sectilis boryana* differs merely in being less constricted at the center of the valve. To add to these other species less clearly related, though similar, as Cleve[f] and De Toni[g] have done, is to lose all boundaries of the species, and, what is worse, to find no halting place whatever. Both the the authors mentioned place this species under *N. powellii* Lewis;[a] to which combination is added by Cleve *N. bartholomei* Cleve.[b] The resemblance between this species and *N. powellii* is slight. Why not then add the more nearly related *N. mirabilis* Leud.-Fort.,[c] *N. intercedens* Schmidt,[d] *N. amica* Cleve & Grun.,[e] and so on ad libitum? This general type of Navicula has a vast number of related forms, and we must draw the line rather strictly around a given species or have no line to draw. For this reason I do not favor making the above a variety of *N. powellii.* I have figured the variety found by me, as it presents the interesting phase of having the marginal as well as the internal rows of costae interrupted at the center, thus making a stauros-like transverse band from side to side.

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[a] Donk. Brit. Diat. *pl. 7. f. 8b.* 1871–73.

[b] Bih. Sv. Vet. Akad. Handl. **3^{15}**: *pl. 1. f. 4.* 1876.

[c] Denkschr. Akad. Wien **48^2**: 56. 1884.

[d] Proc. Roy. Irish Akad. II. **2**: 398. *pl. 33. f. 22.* 1875.

[e] Pant. Beitr. Bacill. Ung. **2**: 52. *pl. 8. f. 155.* 1889.

[f] Sv. Vet. Akad. Handl. **26^2**: 63. 1894.

[g] De Toni, Syll. Alg. **2**: 174. 1891.

Length of (perfect) valve, 0.160 mm.; width of valve, 0.033 mm. Striae, 50 in 0.1 mm.

Found at station 4029H, Bering Sea.

Navicula viridis (Nitzsch) Ehrenb. Infus. 182. *pl. 13. f. 16* (in part), *pl. 21. f. 12.* 1838.

Bacillaria viridis Nitzsch, Neue Schrift. Naturf. Ges. Halle **3:** 97. *pl. 4. f. 1–3.* 1817.

Frustulia viridis Kütz. Linnaea **8:** 551. Syn. Diat. 1833.

Navicula viridula Ehrenb. Infus. 183. *pl. 13. f. 17* (not *pl. 21. f. 14*). 1838, not Kütz.

Pinnularia viridis Ehrenb. in part; Phys. Abh. Akad. Wiss. Berl. **1841:** *pl. 3. I. f. 1–2* (not *pl. 1. I. f. 7. III. f. 3. IV. f. 3*). 1843. W. Smith, Synop. Brit. Diat. **1:** 54. *pl. 18. f. 163a′* (not *f. 163a–b*). 1853. Rabh.; Brun. Diat. Alp. 83. *pl. 8. f. 5* (not *f. 4.*) 1880. Cleve, Sv. Vet. Akad. Handl. **27**^{3}**:** 91. 1895.

Navicula viridis Kütz. Bacill. 97. *pl. 4. f. 18, pl. 30. f. 12.* 1844. Pritch. Hist. Infus. ed. 4. 907. *pl. 9. f. 133–136*(poor). 1861. Schmidt, Atlas *pl. 42. f. 11–14, 19–21.* 1876. Van Heur. Synop. 73. *pl. 5. f. 5* (not *f. 6*). 1881; Treat. Diat. 165. *pl. 2. f. 70* (not *f. 71*). 1896. De Toni, Syll. Alg. **2:** 11. 1891. Eng. & Pr. Pflanzenfam. Bacill. **1**^{1b}**:** 43. *f. 55C–D.* 1896.

Navicula leptogongyla Ehrenb.(?); Schmidt, Atlas *pl. 45. f. 26–28.* 1876.

Navicula commutata Grun.; Schmidt, Atlas *pl. 45. f. 35–37* (not *f. 22–25*). 1876.

Navicula (*Pinnularia*) *rupestris* Hantzsch; Schmidt, Atlas *pl. 45. f. 41–43* (*f. 38–40, 44*?). 1876.

Navicula decumana Pant. Beitr. Bacill. Ung. **3:** *pl. 35. f. 499.* 1893.

This very variable diatom might well be subdivided into several species were it not that the intergradations are so close that no definition of their differences can be made. It approaches another large and variable species, *N. major* Kütz., so that certain forms are about as well referred to one of these as the other.

Found at station 3691H, Okhotsk Sea.

FRUSTULIA C. Ag. char. emend.

Frustulia C. Ag. in part; Syst. Alg. 13. 1824; char. emend. Ag. Consp. Diat. 43. 1832. Rabh. Fl. Eur. Alg. **1:** 20, 227. *f. 64.* Ehrenb. Infus. 231. 1838. Grun. Verh. Zool. Bot. Ges. Wien **12:** 573. 1860. De Toni, Syll. Alg. **2:** 276. 1891. Cleve, Sv. Vet. Akad. Handl. **26**^{2}**:** 121. 1894.

Van Heurckia Breb. Ann. Soc. Phyt. et Micr. Belg. 201. 1868. Van Heur. Synop. 112. *pl. 17. f. 1–2.* 1881; Treat. Diat. 239. *f. 39.* 1896.

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[a] Proc. Acad. Phila. **1861:** 65. *pl. 2. f. 2.* 1862.

[b] Bih. Sv. Vet. Akad. Handl. **5**^{8}**:** 6. *pl. 1. f. 5.* 1878.

[c] Mem. Soc. Emul. St. Brieuc 31. *pl. 2. f. 21.* 1879. Schmidt, Atlas *pl. 160. f. 6–8.* 1890.

[d] Op. cit. *pl. 160. f. 3–5.*

[e] Sv. Vet. Akad. Handl. **18**^{5}**:** 12. *pl. 3. f. 37.* 1881.

Brebissonia Grun. Verh. Zool. Bot. Ges. Wien **12:** 512. 1860. O'Meara, Proc. Roy. Irish Acad. II. **2:** 388 (not fig.). 1875. Van Heur. Treat. Diat. 244. *f. 44.* 1896.

Colletonema Breb. in part; W. Smith, Synop. Brit. Diat. **2:** 70. *pl. 56. f. 351.* 1856.

Cocconema Ehrenb. in part; Ralfs in Pritch. Hist. Infus. ed. 4. 878. *pl. 7. f. 48a–b.* 1861.

Doryphora (Kütz.) W. Smith, Synop. Brit. Diat. **1:** 77. *pl. 24. f. 223.* 1853, in part.

Schizonema C. Ag. in part, Thwaites, Ann. Mag. Nat. Hist. II. **1:** 170. *pl. 12. f. H.* 1848. Van Heur. Synop. *pl. 17. f. 3, 6.* 1881.

Berkeleya Grev., in part; Scott. Crypt. Fl. **1:** 294. 1823, Ralfs, Ann. Mag. Nat. Hist. **16:** 110. *pl. 3. f. 2.* 1845. Van Heur. Treat. Diat. 245. *f. 46.* 1896.

Amphipleura Kütz. Bacill. 103. *pl. 3. f. 52.* 1844, in part. Van Heur. Synop. 113. *pl. 17. f. 14–15.* 1881. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 125. 1894. Van Heur. Treat. Diat. 242. *f. 42.* 1896.

Reicheltia Van Heur. Treat. Diat. 243. *f. 43.* 1896 (?).

Navicula Bory, in part; W. Smith, Synop. Brit. Diat. **1:** 46. *pl. 16. f. 129.* 1853. Kütz. Bacill. 94. *pl. 28. f. 45, pl. 30. f. 44.* 1844. Donk. Brit. Diat. 42. *pl. 6. f. 11–12.* 1872.

The separation of the above genera, in whole or in part, from the true Navicula diatoms is generally felt by students to be necessary. Although they have a naviculoid outline and possess valves that are alike and that bear a raphe divided at the center, they possess several characteristics found in no other naviculoid diatoms. The chief characteristic is the elevated, ridge-like border of silica that surrounds the two halves of the raphe, partly or completely inclosing them and, by its longitudinal extension at the center of the valve (where it represents the central nodule), separating the two halves of the raphe farther and farther, until in Amphipleura and Reicheltia the greater length of the valve is traversed by this ridge and the two halves of the raphe are near the apices. It is on the basis of the gradual extension of this ridge and the consequent progressive separation of the two halves of the raphe that I have here combined these forms into one genus, as it appears to me there is no distinction between the genera above enumerated except this variable one. Viewed from this standpoint the series would be as follows: (1) Frustulia (=Van Heurckia), where the central extension of the ridge is short and the two halves of the raphe traverse nearly the whole length of the valve; (2) Brebissonia (synonymous with Doryphora), where the central extension of the ridge is greater; (3) Berkeleya, where the central extension of the ridge is one-sixth to one-fourth the length of the valve and the two halves of the raphe are correspondingly reduced; (4) Amphipleura and Reicheltia, in which the central extension of the ridge is extreme and the two halves of the raphe very short and near the apices. It seems to me simplicity is gained by this union, since one member of the series runs into another, and especially since they are otherwise greatly alike, being characterized by great delicacy of structure with transverse beaded striae of extreme fineness covering the entire valve, except the ridge. Reicheltia is the most aberrant of this group, its striae being large, though very finely punctate, and the beaded terminations of the divisions of the raphe being peculiar.[a] Still it is so manifestly a unique species of Amphipleura that it is difficult to separate it.

Pfitzer[b] brings out the interesting fact that the above differ strikingly from Navicula in internal structure, in the process of fission, and in that of conjugation.

Frustulia rhomboides (Ehrenb.) De Toni, Syll. Alg. **2:** 277. 1891. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 122. 1894.

Navicula rhomboides Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 419. *pl. 3. I. f. 15.* 1843? Kütz. Bacill. 94. *pl. 28. f. 45, pl. 30. f. 44.* 1844? W. Smith,

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[a] Cf. Van Heur. Treat. Diat. 243. *f. 43.* 1896.

[b] Hanst. Bot. Abhandl. **2:** 1871.

Synop. Brit. Diat. **1**: 46. *pl. 16. f. 129.* 1853. Rabh. Fl. Eur. Alg. **1**: 171. 1864. Pritch. Hist. Infus. ed. 4. 903. 1861. Grun. Verh. Zool. Bot. Ges. Wien **12**: 549. *pl. 3. f. 14a-b.* 1860? Schum. Verh. Zool. Bot. Ges. Wien Suppl. **17**: 68 (not *pl. 3. f. 41*). 1867. Donk. Brit. Diat. 42. *pl. 6. f. 11.* 1842. Lewis, Proc. Acad. Phila. **1865**: 10. *pl. 2. f. 10–11.* 1865. Cleve & Grun. Sv. Vet. Akad. Handl. **17^2**: 47. *pl. 3. f. 59.* 1880.

Colletonema viridulum Breb.; Kütz. Sp. Alg. 105. 1849. H. L. Smith, Sp. Diat. Typ. no. 88. 1874. Pritch. Hist. Infus. ed. 4. 926. 1861.

Navicula crassinervia Breb.; W. Smith, Synop. Brit. Diat. **1**: 47. *pl. 31. f. 271.* 1853. Pritch. Hist. Infus. ed. 4. 900. 1861. Grun. Verh. Zool. Bot. Ges. Wien **12**: 548. *pl. 3. f. 12.* 1860. Donk. Brit. Diat. 42. *pl. 6. f. 12.* 1872. H. L. Smith, Sp. Diat. Typ. no. 313. 1874.

Frustulia torfacea A. Braun in Rabh. Sussw. Diat. 50. *pl. 7. f. 2.* 1853.

Frustulia saxonica Rabh. Fl. Eur. Alg. **1**: 227. 1864. Griff. & Henf. Micr. Dict. ed. 3. 323. *pl. 14. f. 17.* 1875. H. L. Smith, Sp. Diat. Typ. no. 172. 1874. Rabh. Sussw. Diat. 50. *pl. 7. f. 1.* 1853. Pritch. Hist. Infus. ed. 4. 924. 1861. Pfitz. in Hanst. Bot. Abhandl. **2**: 58. *pl. 4. f. 4–8.* 1871.

Schizonema viridulum Rabh. Fl. Eur. Alg. **1**: 266. 1864.

Vanheurckia rhomboides Breb. Ann. Soc. Phyt. et Micr. Belg. 204. 1868. Van Heur. Synop. 112. *pl. 17. f. 1–2.* 1881; Treat. Diat. 240. *pl. 5. f.* 249–250. Truan, Anal. Soc. Espan. Hist. Nat. **13**: 352. *pl. 8. f. 1.* 1884.

Vanheurckia crassinervia Breb. Ann. Soc. Phyt. et Micr. Belg. 204. 1868. Van Heur. Synop. *pl. 17. f. 4–5.* 1881. Truan, Anal. Soc. Espan. Hist. Nat. **13**: 352. *pl. 8. f. 2.* 1884.

Vanheurckia viridula Breb. Ann. Soc. Phyt. et Micr. Belg. 203. 1868. Van Heur. Synop. 112. *pl. 17. f. 3.* 1881.

Frustulia viridula De Toni, Syll. Alg. **2**: 278. 1891.

I have worked out the above extensive synonymy because this diatom is very widely distributed and has been included in the older as well as the more recent diatom literature under so many names that the nomenclature is very confusing. In one or two instances I have left out supposed synonyms, because their exact application is impossible to determine. Thus *Navicula lineolata* Ehrenb.[a] is included by Cleve[b] in the above, though upon what basis I can not determine. The figures and descriptions of Ehrenberg convey no image sufficiently exact to determine even if it belongs to this genus, much less if to this species. In fact, De Toni includes it, and with as much reason, under *Navicula serians* (Breb.) Kütz.[c] Many of Ehrenberg's figures are quite unlike the others. The same is true to some extent of the original *Navicula rhomboides* Ehrenb., from which the above specific name is derived; and I would not hesitate to pass over this authority, were it not for the fact that this particular name has been so constantly repeated by succeeding authors with better figures and descriptions that it is pretty certain this particular diatom is meant in each instance. As these diatoms, though sometimes free, are generally inclosed in gelatinous tubes or masses, the older observers gave especial attention to this transient condition; and in many cases we have elaborate descriptions of the appearance of these forms in bulk, without a word on the sculpture or build of the frustules; and where figures of the original plants are attempted they are likely to be so minute as to be worthless. Cleve has repeatedly stated his inability to identify some of these earlier figures and descriptions.

Found at station 2885, off Oregon.

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[a] Phys. Abh. Akad. Wiss. Berl. **1841**: 418. *pl. 1. III. f. 4a, pl. 2. VI. f. 27, pl. 4. I. f. 6.* 1843; Mikrog. *pl. 16. I. f. 3, II. f. 1–2.* 1854.

[b] Sv. Vet. Akad. Handl. **26^2**: 122. 1894.

[c] De Toni, Syll. Alg. **2**: 141. 1891.

GYROSIGMA Hass.

Gyrosigma Hass. Hist. Brit. Algae **1**: 435. *pl. 102. f. 11.* 1845. Rabh. Süssw. Diat. 47. 1853. Cleve, char. emend. Sv. Vet. Akad. Handl. **26**^{2}: 112. 1894.

Pleurosigma W. Smith, Ann. Mag. Nat. Hist. 1. *pl. 1-2.* 1852. Synop. Brit. Diat. **1**: 61. *pl. 20-22.* 1853. Rabh. Fl. Eur. Alg. **1**: 230. 1864. Pritch. Hist. Infus. ed. 4. 915. 1861. Grun. Verh. Zool. Bot. Ges. Wien **10**: 555. 1860. Cleve & Grun. Sv. Vet. Akad. Handl. **17**^{2}: 48. 1880. Van Heur. Synop. 114. *pl. 18-21.* 1881; Treat. Diat. 249. *pl. 6-7. 28.* 1896. Perag. Le Diatomiste **1**$^{4-5}$: 1-35. *pl. 1-10.* 1891. Castr. Rep. Voy. Chall. Bot. **2**: 36. 1886. Griff. & Henf. Micr. Dict. ed. 4. 606. *pl. 15.* 1883. De Toni. Syll. Alg. **2**: 231. 1891. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 112. 1894.

Frustulia C. Ag. in part; Kütz. Linnaea **8**: 555 (nos. 49-50). *pl. 14. f. 35-36.* 1833.

Navicula Bory, in part; Ehrenb. Infus. 180-181 (nos. 226-230). *pl. 13. f. 10-14.* 1838. Kütz. Bacill. 102 (no. 132). *pl. 4. f. 32.* 1844.

Toxonidea Donk. Trans. Micr. Soc. Lond. n. s. **6**: 19. *pl. 4. f. 1-2.* 1858. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 45. 1894. Van Heur. Treat. Diat. 247. 1896. Pritch. Hist. Infus. ed. 4. 920. 1861. Perag. Le Diatomiste **1**$^{4-5}$: 27. *pl. 9.* 1891.

Donkinia Ralfs in Pritch. Hist. Infus. ed. 4. 920. *pl. 8. f. 49.* 1861. Van Heur. Treat. Diat. 248. 1896. Perag. Le Diatomiste **1**$^{4-5}$: 29. *pl. 9.* 1891.

Rhoicosigma Grun. Hedwigia **6**: 40. 1867. Van Heur. Treat. Diat. 260. 1896. Perag. Le Diatomiste **1**$^{4-5}$: 30. *pl. 9-10.*

This genus of diatoms is one of the best defined and most sharply separated of the large genera. Its valves are more or less sigmoid, both as to their outline and in respect to the trend of the raphe. They are evenly marked with delicate striations of great beauty and often of extreme delicacy, either in two directions, transverse and longitudinal, or in three directions, one transverse and two oblique, the three being at angles approximately of 60° to each other. This striation covers the entire valve with a gauzy network, except a very narrow longitudinal space through which runs the raphe and a minute area around the central nodule. The valves are as a rule convex, thin, made up of two or three layers, and therefore strongly prismatic. The zonal view is in most cases extremely narrow compared to the valval view. Their beauty, wide distribution, and importance as tests of the efficiency of microscope objectives have resulted in their being more generally known and carefully studied than most other genera.

William Smith's generic name, Pleurosigma, is very appropriate and has been universally accepted in preference to the earlier one of Hassall. But there can be no question of the validity of Gyrosigma. We find it in his British Algae as a monotypic genus, based on *G. hippocampa* (Ehrenb.) Hass., the description and illustration of which are unmistakable. Hassall also quotes Ehrenberg's excellent reference to this diatom,[a] as *Navicula hippocampus* Ehrenb. The reasons advanced by Brebisson, Ralfs, and others, for preferring Smith's name are wholly inadequate; and although we are indebted to Smith for a most clear and comprehensive analysis of this genus it is necessary to recognize the right of Hassall's name to represent these diatoms.

Several attempts have been made to create new genera out of certain species of Gyrosigma having more or less striking peculiarities. The first was the separation of all species having an arcuate instead of sigmoid raphe, with valves extremely convex on one side and nearly straight on the other (i. e., strongly asymmetrical on their longitudinal axis). These were placed in a genus, Toxonidia, by Donkin.[b] The next separation was by Ralfs of valves with extremely sigmoid raphe, the ridge of the raphe being raised into a keel above the rest of the valve, except at the central nodule.

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[a] Ehrenb. Infus. 180. *pl. 13. f. 11.* 1838.

[b] Donk. Trans. Micr. Soc. Lond. n. s. **6**: 19. *pl. 3. f. 1.* 1858. Moeb. Diat.-taf. *pl. 18, f. 1.* 1890.

These he called Donkinia.[a] The third genus to be separated was Rhoicosigma by Grunow,[b] including all species with strongly bent frustules (seen in zonal view) and with valves sometimes, though not always, dissimilar. These distinctions have been accepted by Van Heurck, Peragallo, and De Toni. Cleve rejects them, except Toxonidea, and accepts this, as he admits, on dubious grounds. I think nothing is gained by breaking up the generic unity of this sharply marked genus. The characteristics, as Cleve points out,[c] are variable in each of the above cases. For subgeneric division they can be, at least at present, made use of; but beyond this they only increase the difficulty of assigning diatoms that have the clear Gyrosigma qualities.

Cleve has, however, gone further than others toward obliterating the worth of this genus by dividing it into two genera on the sole basis of the direction of the striation. He includes all forms with transverse-longitudinal striae in Gyrosigma (Hass.) Cleve, and the others, with striae in three directions (excepting Toxonidea) in Pleurosigma (W. Smith) Cleve. It is probably true, as he says, that there are no transitional forms between these two kinds; indeed, it would not be easy to conceive how there could be, for lines in two directions could hardly change to lines in three directions without assuming new angles, and only one of the three lines could possibly remain in the original direction of one of the two lines; and this is just what we find, both the two-line and three-line forms having one of the lines transverse. The lack of transition is, therefore, to my mind an empty argument. If, now, we look at the striking forms, called by Ralfs Donkinia, a genus rejected by Cleve, we find species of both two-line and three-line sculpture that are far too close to put into separate genera, on any reasonable interpretation of a genus; thus *D. recta* (Donk.) Grun. and *D. carinata* (Donk.) Ralfs.[d] Whoever also compares such two-line forms as *G.* (*Pleurosigma*) *littorale* (W. Smith) Griff. & Henf. and *G.* (*Pleurosigma*) *acuminatum* (Kütz.) Grun. with such three-line forms as *G.* (*Pleurosigma*) *latum* Grun. and *G.* (*Pleurosigma*) *affine* Grun. must see that it is artificial to place them in two genera. I do not therefore look upon Cleve's division of this genus as having the merit of the earlier ones.

Gyrosigma aestuarii (Breb.) Griff. & Henf. Micr. Dict. ed. 3. 356. *pl. 11. f. 35.* 1875.

Navicula aestuarii Breb.; Kütz. Sp. Alg. 890. 1849.

Pleurosigma aestuarii W. Smith, Synop. Brit. Diat. **1**: 65. *pl. 31. f. 275.* 1853. Cleve & Grun. Sv. Vet. Akad. Handl. **17**^{2}: 52. 1880. Perag. Le Diatomiste **1**$^{4-5}$: 12. *pl. 5. f. 12–13, 15.* 1891. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 42. 1894. Pritch. Hist. Infus. ed. 4. 916. 1861. Rabh. Fl. Eur. Alg. **1**: 234. 1864. Griff. & Henf. Micr. Dict. ed. 3. *pl. 15. f. 35* (*f. 33c*?). 1875. Van Heur. Synop. *pl. 18. f. 8.* 1881. H. L. Smith, Sp. Diat. Typ. no. 394. 1874 (not Cleve, Bih. Sv. Vet. Akad. **1**^{11}: 13. *pl. 2. f. 19.* 1873=*P. normanii* Ralfs).

Pleurosigma angulatum W. Smith, variety; Van Heur. Synop. 115. 1881; Treat. Diat. 251. *pl. 6. f. 258.* 1896. De Toni, Syll. Alg. **2**: 232. 1891.

Pleurosigma candidum Schum. Schrift. Phys. Ökon. Ges. Konigsb. **8**: 59. *pl. 2. f. 57.* 1867. Perag. Le Diatomiste **1**$^{4-5}$: 12. *pl. 5. f. 11.* 1891.

The desire of H. L. Smith, Van Heurck, and De Toni to make this a variety of *P. angulatum* W. Smith is not to be commended. Though smaller than the latter, the markings are decidedly coarser, the ends narrower and less gracefully tapered, and in the type form slightly but sharply bent sidewise.

Found at station 2823, Gulf of California.

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[a] Pritch. Hist. Infus. ed. 4. 921. *pl. 8. f. 49.* 1861.

[b] Sv. Vet. Akad. Handl. **17**^{2}: 58. 1880. Le Diatomiste **1**$^{4-5}$: 33. *pl. 10. f. 2–3.* 1891.

[c] Sv. Vet. Akad. Handl. **26**^{2}: 32, 112. 1894.

[d] Trans. Micr. Soc. Lond. n. s. **6**: *pl. 3. f. 5, 6.* 1858. Le Diatomiste **1**$^{4-5}$: *pl. 9. f. 6, 8.* 1891.

Gyrosigma formosum (W. Smith) Griff. & Henf. Micr. Dict. ed. 3. 355. *pl. 11. f. 25.* 1875.

Pleurosigma formosum W. Smith, Ann. Mag. Nat. Hist. II. **9**: 5. *pl. 1. f. 1–2.* 1852; Synop. Brit. Diat. **1**: 63. *pl. 20. f. 195.* 1853. Rabh. Fl. Eur. Alg. **1**: 231. 1864. Cleve & Grun. Sv. Vet. Akad. Handl. $\mathbf{17^2}$: 48. 1880. Van Heur. Synop. 116. *pl. 19. f. 4.* H. L. Smith, Sp. Diat. Typ. no. 402. 1874. Pritch. Hist. Infus. ed. 4. 917. *pl. 8. f. 32.* 1861. Griff. & Henf. Micr. Dict. ed. 3. *pl. 11. f. 25.* 1875. Cleve, Sv. Vet. Akad. Handl. $\mathbf{26^2}$: 45. *pl. 4. f. 21.* 1894. De Toni, Syll. Alg. **2**: 243. 1891. Perag. Le Diatomiste $\mathbf{1^{4-5}}$: 4. *pl. 1. f. 1–6.* 1891. Van Heur. Treat. Diat. 254. *pl. 6. f. 268.* 1896.

Pleurosigma decorum W. Smith, Synop. Brit. Diat. **1**: 63. *pl. 21. f. 196.* 1853. Pritch. Hist. Infus. ed. 4. 918. 1861. Rabh. Fl. Eur. Alg. **1**: 232. 1864. H. L. Smith, Sp. Diat. Typ. no. 694. 1874. Cleve in Nordensk. Vega Exped. **3**: 497, 506. 1883. Van Heur. Synop. 116. *pl. 19. f. 1.* 1881. Perag. Le Diatomiste $\mathbf{1^{4-5}}$: 5. *pl. 1. f. 9–13* (*pl. 2. f. 6–9* doubtful). 1891. Van Heur. Treat. Diat. 254. *pl. 6. f. 269.* 1896. Griff. & Henf. Micr. Dict. ed. 3. *pl. 11. f. 26.* 1875. De Toni, Syll. Alg. **2**: 243. 1891.

Pleurosigma australicum Witt, Journ. Mus. Godef. **1**: 70. *pl. 8. f. 7.* 1873. De Toni, Syll. Alg. **2**: 246. 1891.

Pleurosigma tahitiense Witt, Journ. Mus. Godef. **1**: 67. *pl. 8. f. 13.* 1873. De Toni, Syll. Alg. **2**: 245. 1891 (not *P. tahitiense* Castr. Rep. Voy. Chall. Bot. **2**: 38. *pl. 28. f. 4.* 1886).

Pleurosigma pulchrum Grun.; H. L. Smith, Sp. Diat. Typ. no. 695. 1874 (not *P. pulchrum* Grun. Verh. Zool. Bot. Ges. Wien **10**: 556. *pl. 4. f. 2.* 1860; not Perag. Le Diatomiste $\mathbf{1^{4-5}}$: 4. *pl. 1. f. 81.* 1891.).

The Grunow variety *longissima*, as figured by Peragallo,[a] occurs at station 2848 and an unusually large and robust variety at station 3603; also the *P. decorum* variety at station 3712H.

Found at stations 2848, 2929, 3603, 3691H, 3712H, Okhotsk and Bering seas to southern California.

Gyrosigma inermedium (W. Smith) Griff. & Henf. Micr. Dict. ed. 3. 356. *pl. 11. f. 36.* 1875.

Pleurosigma intermedium W. Smith, Synop. Brit. Diat. **1**: 64. *pl. 21. f. 200.* 1853. Pritch. Hist. Infus. ed. 4. 918. 1861. Van Heur. Synop. 116. *pl. 18. f. 6.* 1881. Treat. Diat. 253. *pl. 6. f. 267.* 1896. H. L. Smith, Sp. Diat. Typ. no. 405. 1874. De Toni, Syll. Alg. **2**: 235. 1891. Perag. Le Diatomiste $\mathbf{1^{4-5}}$: 13. *pl. 5. f. 27–28* (*f. 29* doubtful). 1891. Cleve & Grun. Sv. Vet. Akad. Handl. $\mathbf{17^2}$: 52. 1880. Rabh. Fl. Eur. Alg. **1**: 234. 1864 (not Truan, Anal. Soc. Espan. Hist. Nat. **13**: 49. *pl. 9. f. 2.* 1884).

Pleurosigma nubecula W. Smith, Synop. Brit. Diat. 1: 64. *pl. 21. f. 201.* 1853. Cleve, Sv. Vet. Akad. Handl. $\mathbf{26^2}$: 34. 1894. De Toni, Syll. Alg. **2**: 235. 1891. Rabh. Fl. Eur. Alg. **1**: 232. 1864. Perag. Le Diatomiste $\mathbf{1^{4-5}}$: 14. *pl. 5. f. 26.* 1891.

Pleurosigma thumii Castr.; Perag. Le Diatomiste $\mathbf{1^{4-5}}$: 14. *pl. 5. f. 25.* 1891.

Pleurosigma subrectum Cleve in Cleve & Grun. Sv. Vet. Akad. Handl. $\mathbf{17^2}$: 14, 53. *pl. 3. f. 72.* 1880. Perag. Le Diatomiste $\mathbf{1^{4-5}}$: 14. *pl. 5. f. 30.* 1891.

Pleurosigma elongatum balaericum Perag. Le Diatomiste **1**: 7. *pl. 2. f. 22.* 1891.

Cleve agrees to the practical identity of *P. intermedium* and *P. nubecula*, as do Van Heurck and Peragallo, but for some reason he has selected the less known name *nubecula*, occurring after *intermedium* in Smith's work, instead of *intermedium*.

Found at station 3091, off Oregon.

Gyrosigma normanii (Ralfs) Mann.

Pleurosigma normanii Ralfs; Pritch. Hist. Infus. ed. 4. 919. 1861. Rabh. Fl. Eur. Alg. **1**: 236. 1864. Cleve & Grun. Sv. Vet. Akad. Handl. $\mathbf{17^2}$: 14, 52. *pl. 3. f. 67.*

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[a] Loc. cit.

1880. De Toni, Syll. Alg. **2**: 237. 1891. Cleve, Sv. Vet. Akad. Handl. **26^2**: 40. 1894.

Pleurosigma affine Grun.; Cleve & Grun. Sv. Vet. Akad. Handl. **17^2**: 51. 1880. Van Heur. Synop. 115. *pl. 18. f. 9.* 1881; Treat. Diat. 252. *pl. 6. f. 263* (not *f. 264*). 1896. Perag. Le Diatomiste **1^{4-5}**: 9. *pl. 4. f. 5–8, 15–18* (not *f. 4; f. 1–3* doubtful). 1891.

Pleurosigma virginicum H. L. Smith, Sp. Diat. Typ. no. 416. 1874.

Van Heurck places here *P. nicobaricum* Grun.,[a] probably basing it on Grunow's *P. affine nicobarica.*[b] I doubt the wisdom of calling this a variety of *P. affine.* Certainly Grunow's type in the above citation and in Peragallo's Monograph[c] should not be forced into this species. As Cleve points out, it is nearer to *P. validum* Shadb.

Found at stations 2844, 3607, Aleutian Islands and Bering Sea.

Gyrosigma rigidum (W. Smith) Griff. & Henf. Micr. Dict. ed. 3. 356. *pl. 11. f. 30.* 1875.

Pleurosigma rigidum W. Smith, Synop. Brit. Diat. **1**: 64. *pl. 20. f. 198. 1853.* Pritch. Hist. Infus. ed. 4. 918. 1861. Rabh. Fl. Eur. Alg. **1**: 232. 1864. H. L. Smith, Sp. Diat. Typ. no. 410. 1874. Van Heur. Synop. *pl. 19. f. 3.* 1881; Treat. Diat. 251. *pl. 6. f. 265.* 1896. Truan, Anal. Soc. Espan. Hist. Nat. **13**: 49. *pl. 9. f. 4.* 1884. De Toni, Syll. Alg. **2**: 237. 1891. Cleve, Sv. Vet. Akad. Handl. **26^2**: 39. 1894. Perag. Le Diatomiste **1^{4-5}**: 14. *pl. 6. f. 2–7.* 1891. Griff. & Henf. Micr. Dict. ed. 4. *pl. 15. f. 30.* 1883.

Pleurosigma validum Shadb. Trans. Micr. Soc. Lond. n. s. **2**: 16. *pl. 1. f. 8.* 1854. Cleve & Grun. Sv. Vet. Akad. Handl. **17^2**: 53. 1880. De Toni, Syll. Alg. **2**: 245. 1891.

Pleurosigma giganteum Grun.; Cleve & Grun. Sv. Vet. Akad. Handl. **17^2**: 53. 1880 (not *P. giganteum* Grun. Verh. Zool. Bot. Ges. Wien **10**: 558. *pl. 4. f. 1.* 1860).

In the last name there is a confusion on the part of the author, which is repeated in several other works. The original *P. giganteum* is not only plainly drawn as a transverse-longitudinal striated species, but is so described, the ambiguous sentence "lineolis decussatis subtillimis" not necessarily meaning oblique lined, as any line at right angles to another is strictly "decussating." In the case of oblique striation Grunow in that work uses such expressions as "in lineas obliquas." Moreover, he expressly says of *P. giganteum*, "Am nächsten steht ihm das folgende *Pleurosigma tropicum*, welches jedoch durch kleinere Gestalt und stärkere Biegung wesentlich verschieden ist." This diatom is also figured and described with transverse-longitudinal striæ and is universally recognized as having that character. Yet Grunow in his later works[d] unites *P. giganteum* to *P. validum* Shadb., and says of his own species, "*Pl. giganteum* hat 18 schiefe und 17 Querstreifen," and it is so figured by Peragallo and others.

At station 2807 occurs a small and delicate variety agreeing with a figure[e] which Peragallo erroneously speaks of as typical.

Found at stations 2807, 3520, Galapagos Islands and Bering Sea.

Gyrosigma sagitta (Temp. & Brun) Mann.

Pleurosigma sagitta Temp. & Brun, Mem. Soc. Phys. et Hist. Nat. Geneva **30^9**: 49. *pl. 9. f. 19.* 1889. De Toni, Syll. Alg. **2**: 242. 1891.

There is reasonable doubt of this being a synonym of *P. nicobaricum* Grun.,[f] with which it is united by Cleve and others. It not only lacks the double-rowed transverse markings of the latter (though these Grunow admits are inconstant) but it does not show transverse lines wider and heavier than the oblique, but the three sets about equal and growing finer toward the apices. Nor is there any trace of a rectangular, finely punctate central area. It must be said, however, that both these are close to minute forms of *G. rigidum.* I have with some doubt left it, as De Toni does, as a separate species.

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[a] Fenzl, Reise Novara Bot. **1**: 101. *pl. 1A. f. 20.* 1870.

[b] Van Heur. Synop. 115; Suppl. *pl. C. f. 34.* 1881-5. Cf. Van Heur. Treat. Diat. 252. *pl. 6. f. 264.* 1896. Perag. Le Diatomiste **1^{4-5}**: *pl. 4. f. 10–12.* 1891.

[c] Perag. op. cit. *pl. 4. f. 9.*

[d] Sv. Vet. Akad. Handl. **17^2**: 53. 1880.

[e] Le Diatomiste **1^{4-5}**: *pl. 6. f. 6.* 1891.

[f] Fenzl, Reise Novara Bot. **1**: 101. *pl. 1A. f. 20.* 1870.

Found at station 4029H, Bering Sea.

Gyrosigma speciosum (W. Smith) Griff. & Henf. Micr. Dict. 356. *pl. 11. f. 28.* 1875.

Pleurosigma speciosum W. Smith, Ann. Mag. Nat. Hist. II. **9**: 6. *pl. 1. f. 3.* 1852; Synop. Brit. Diat. **1**: 63. *pl. 20. f. 197.* 1853. Cleve, Sv. Vet. Akad. Handl. $\mathbf{26}^2$: 44. 1894. De Toni, Syll. Alg. **2**: 236. 1891. Pritch. Hist. Infus. ed. 4. 917. 1861. Rabh. Fl. Eur. Alg. **1**: 232. 1864. Griff. & Henf. Micr. Dict. ed. 4. *pl. 15. f. 28.* 1883. Van Heur. Treat. Diat. 253. *pl. 28. f. 793.* 1896. Cleve. & Grun. Sv. Vet. Akad. Handl. $\mathbf{17}^2$: 49. 1880. Castr. Rep. Voy. Chall. Bot. **2**: 37. *pl. 28. f. 2.* 1886. Perag. Le Diatomiste $\mathbf{1}^{4-5}$: 6. *pl. 2. f. 13–19* (not *f. 10, 12; f. 11* doubtful). 1891.

Pleurosigma pulchrum Grun. Verh. Zool. Bot. Ges. Wien **19**: 556. *pl. 4. f. 2.* 1869. Perag. Le Diatomiste $\mathbf{1}^{4-5}$: 4. *pl. 1. f. 8* (doubtful). 1891 (not *P. pulchrum* Grun.; H. L. Smith, Sp. Diat. Typ. no. 695. 1874=*G. formosum*).

There is a fine gradation over from this species to *G. formosum*, though the two are to be viewed as safely distinct. Thus H. L. Smith's *P. pulchrum* is close to *G. formosum* and is best classed there. The real *P. pulchrum* Grun., on the other hand, is a variety of the present species and yet is reasonably close to Smith's form. I do not favor placing here, as is done by Cleve, *P. tortuosum* Cleve;[a] a diatom of the extreme Donkinia type; nor the inclusion suggested by Peragallo, of *P. tahitiense* Castr.[b]

Found at station 3607, Bering Sea.

Gyrosigma thuringicum (Kütz.) Rabh. Sussw. Diat. 47. *pl. 5. f. 4.* 1853.

Navicula thuringica Kütz. Bacill. 102. *pl. 4. f. 27.* 1844.

Navicula angulata Quek. Treat. Micr. 438. *pl. 8. f. 4–7.* 1848.

Pleurosigma angulatum W. Smith, Ann. Mag. Nat. Hist. II. **9**: 7. *pl. 1. f. 7–9.* 1852; Synop. Brit. Diat. **1**: 65. *pl. 21. f. 205.* 1853. Rabh. Fl. Eur. Alg. **1**: 234. 1864. Pritch. Hist. Infus. ed. 4. 918. 1861. H. L. Smith, Sp. Diat. Typ. no. 389–391. 1874. Cleve & Grun. Sv. Vet. Akad. Handl. $\mathbf{17}^2$: 51. 1880. Van Heur. Synop. 115. *pl. 18. f. 2–5.* 1881–85; Treat. Diat. 351. *pl. 6. f. 257, 259–260* (not *f. 258, 261*). 1896. Truan, Anal. Soc. Espan. Hist. Nat. **13**: 48. *pl. 9. f. 1.* 1884. Griff. & Henf. Micr. Dict. ed. 4. 607. *pl. 15. f. 33.* 1883. Perag. Le Diatomiste $\mathbf{1}^{4-5}$: 11. *pl. 5. f. 3–6.* 1891. De Toni, Syll. Alg. **2**: 231. 1891. Cleve, Sv. Vet. Akad. Handl. $\mathbf{26}^2$: 40. 1894.

Pleurosigma thuringicum Ralfs; Pritch. Hist. Infus. ed. 4. 919. 1861.

Pleurosigma quadratum W. Smith, Synop. Brit. Diat. **1**: 65. *pl. 20. f. 204, 204B.* 1853. Rabh. Fl. Eur. Alg. **1**: 235. 1864. Pritch. Hist. Infus. ed. 4. 918. 1861. Griff. & Henf. Micr. Dict. ed. 4. *pl. 15. f. 34.* 1883. Truan, Anal. Soc. Espan. Hist. Nat. **13**: 45. *pl. 9. f. 3.* 1884. Perag. Le Diatomiste $\mathbf{1}^{4-5}$: 11. *pl. 5. f. 7–8.* 1891. Van Heur. Synop. *pl. 18. f. 1.*

That this diatom, known almost universally as *Pleurosigma angulatum* W. Smith, is identical with Kützing's *Navicula thuringica* there can be no doubt. Although he omits all data regarding the striation, this is not surprising, as he usually calls most diatoms with as delicate markings as this one "laevis" or "laevissimus," as he does here. Its build is most characteristic. Rabenhorst, Ralfs, Grunow, Van Heurck, De Toni, and in fact nearly every author recognizes the identity of the two. De Toni makes *N. thuringica* Kütz. a synonym of *P. angulatum* (Quek.) W. Smith, but says after the former, "Nomen anterius!!" Grunow[a] gives the following important testimony: "*Navicula thuringica* Kg. ist nach Exemplaren von Arten im Kützing'schen Herbar. identisch mit *Pl. angulatum*, so dass die Art eigentlich *Pl. thuringicum* heissen sollte." Van Heurck, after quoting *N. thuringica* Kütz. as a synonym of *P. angulatum* and following it with an exclamation point, adds this statement; "Cette espèce devrait donc porter le nom de *Pl. thuringica*, ce changement de nom est cependant impossible, car cette diatomée si repandue et si employée comme test, est universellement connue sous le nom donné par W. Smith." There is no question that the change of name here made is an unfortunate necessity, as this particular species is the best known of all the diatoms; and it is with reluctance that the name which should have been accorded to it over fifty years ago is here preferred.

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[a] Sv. Vet. Akad. Handl. $\mathbf{18}^5$: 5. *pl. 1. f. 6.* 1881.

[b] Castr. Rep. Voy. Chall. Bot. **2**: 38. *pl. 23. f. 4.* 1886. Perag. Le Diatomiste $\mathbf{1}^{4-5}$: *pl. 2. f. 10.* 1891.

Cleve adds to the above list of synonyms *P. strigosum* W. Smith,[b] *P. normanii* Ralfs,[c] and *P. finnmarchicum* Cleve.[d] These three are alike; but with their blunt apices, smooth outline, coarser markings, and more sigmoid raphe they are very bad examples of varieties of the present species. De Toni, who gives separate rank to *P. normanii*, unites under *P. angulatum* some impossible forms, such as *P. delicatulum* W. Smith.[e]

The variety corresponding to *P. quadratum* W. Smith is very abundant at station 3603.

Found at stations 2919, 3200H, 3603, 3696, 4530H, Honshu Island, Japan, to Bering Sea, southern California, and Santa Cruz Island, West Indies.

PLAGIOTROPIS Pfitz.

Plagiotropis Pfitz. in Hanst. Bot. Abhand. **2**: 93. 1871. Van Heur. Synop. 121. 1881. De Toni, Syll. Alg. **2**: 343. 1891. Cleve & Grun. Sv. Vet. Akad. Handl. **17²**: 66. 1880.

Amphiprora Ehrenb. in part; Greg. Trans. Roy. Soc. Edinb. **21**: 505. *pl. 12. f. 58.* 1857.

Tropidoneis Cleve, in part; Sv. Vet. Akad. Handl. **27³**: 27. 1895.

I admit this genus with hesitation, as it is very doubtful if anything is gained by separating its forms from Amphiprora. The genus is hard to understand, on account of the contorted and pellucid character of the diatoms. I lean toward a union of all its forms under Amphiprora; but as I have not been able to establish a satisfactory reason for this by an exhaustive study of the different species, I classify the single species found during these investigations under its generally accepted name. If Cleve's contention that this genus should be included in his later genus Tropidoneis is correct, it would have been better to have enlarged and emended this genus instead of creating a new one.

Plagiotropis van heurckii Grun.; Van Heur. Synop. 122. *pl. 22bis. f. 6-8.* 1881. De Toni, Syll. Alg. **2**: 346. 1891.

Tropidoneis van heurckii Cleve, Sv. Vet. Akad. Handl. **26²**: 27. 1894. Van Heur. Treat. Diat. 265. *pl. 6. f. 295.* 1896.

Found at station 2807, Galapagos Islands.

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[a] Sv. Vet. Akad. Handl. **17²**: 52. 1880.

[b] Ann. Mag. Nat. Hist. II. **9**: 7. *pl. 1. f. 7.* 1852.

[c] Pritch. Hist. Infus. ed. 4. 919. 1861; cf. Sv. Vet. Akad. Handl. **17²**: 52. *pl. 3. f.* 67. 1880.

[d] Denkschr. Akad. Wien **48²**: 105. 1884.

[e] W. Smith, Synop. Brit. Diat. **1**: 64. *pl. 21. f. 202.* 1853.

AMPHIPRORA Ehrenb.

Amphiprora Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 401, 410. 1843. Kütz. Sp. Alg. 93. 1849. Van Heur. Synop. 120. 1881.

Entomoneis Ehrenb. Phys. Abh. Akad. Wiss. Berl. 154. 1845.

Amphicampa Rabh. Fl. Eur. Alg. **1**: 257. 1864.

Amphitropis Rabh. in Hanst. Bot. Abhand. **2**: 94. 1871. Grun. Denkschr. Akad. Wien **48**^{2}: 53. *pl. A. f. 52–53.* 1884.

The complicated figure of these diatoms is due mainly to the fact that they are, as a rule, contorted spirally about their long axis through an arc of 90° or less, making the build, which is naviculoid, difficult to understand. The genus is close to Amphora Ehrenb., Plagiotropis Pfitz., and Auricula Castr.

Amphiprora conspicua Grev. Trans. Micr. Soc. Lond. n. s. **9**: 86. *pl. 10. f. 16.* 1861. Moeb. Diat.-taf. *pl. 40. f. 16.* 1890. Van Heur. Synop. *pl. 22bis. f. 3.* 1881. De Toni, Syll. Alg. **2**: 335. 1891.

Amphiprora pulchra var. B. Lewis, Proc. Acad. Phila. **1863**: 346. *pl. 1. f. 10.* 1864.

Van Heurck's figure above represents a doubtful aspect of this species.

Found at station 3604, Bering Sea.

MASTOGLOIA Thwaites.

Mastogloia Thwaites; W. Smith, Synop. Brit. Diat. **2**: 63. *pl. 54. f. 340–341, pl. 62. f. 388–389.* 1856. Grun. Verh. Zool. Bot. Ges. Wien **12**: 574. *pl. 5. f. 4–8.* 1860. De Toni, Syll. Alg. **2**: 313. 1891. Rabh. Fl. Eur. Alg. **1**: 20, 260. *f. 65.* 1864. Pritch. Hist. Infus. ed. 4. 924. *pl. 15. f. 30.* 1861. Van Heur. Synop. 69. *pl. 4. f. 13–28.* 1881–85; Treat. Diat. 153. *f. 28, pl. 2. f. 60–66.* 1896. O'Meara, Proc. Roy. Irish Acad. II. **2**: 323. *pl. 29. f. 9–13.* 1875. Brun, Diat. Alp. 92. *pl. 8. f. 28–29.* 1880. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 142. 1894.

Pleurosiphonia Ehrenb. Monatsb. Akad. Wiss. Berl. **1853**: 203. 1854, nom. nud.; **1856**: 338 *pl. 1. f. 32.* 1857; Mikrog. 59. 199. *pl. 33. I. f. 14.* 1854. Abh. Akad. Wiss. Berl. **1870**: 52, 58. *pl. 3. III. f. 1–6.* 1871. Pritch. Hist. Infus. ed. 4. 915. 1861. De Toni, Syll. Alg. **2**: 326. 1891.

Stigmaphora Wall. Trans. Micr. Soc. Lond. n. s. **8**: 43. *pl. 2. f. 5–8.* 1860. Moeb. Diat.-taf. *pl. 31. f. 5–8.* 1890. De Toni, Syll. Alg. **2**: 325. 1891. Van Heur. Treat. Diat. 156. *f. 28a.* 1896?

Navicula Bory in part; Grun. Verh. Zool. Bot. Ges. Wien **13**: 151. *pl. 14. f. 12.* 1863; in Fenzl, Reise Novara Bot. **1**: 99. *pl. 1A. f. 11.* 1870.

Dickieia Berkeley in part; Thwaites, Ann. Mag. Nat. Hist. II. **1**: 171. *pl. 12. f. K.* 1848.

Cocconeis Ehrenb. in part; Grun. Verh. Zool. Bot. Ges. Wien **10**: 577. *pl. 5. f. 10a–d.* 1860.

This genus is of most questionable merit. As a convenience in reducing somewhat the unwieldy genus Navicula, it is of advantage, but it is doubtful whether it deserves generic rank on its own merits. The structure of the frustule displays all the characteristics of Navicula, except in having a more or less evident row of internal loculi along the margins of the valves, from the center toward or to the apices. In this it agrees with certain species of Cocconeis Ehrenb., to which for that reason it was joined by Grunow in his genus, Orthoneis. It differs, however, from Cocconeis in having both valves alike. To admit that this internal plate structure is a generic mark is to invite confusion in some other genera. Leaving out the untenable breaking up of Cocconeis already mentioned, there is *Navicula cuspidata* Kütz. This diatom I have found at Farmingdale, New Jersey marl pits, both with and without the large internal craticular plates, which when separated from the frustule were known for a long time as *Surirella craticula* Ehrenb. They are more pronounced structures than the marginal plates of

Mastogloia, but we can not for that reason divide *N. cuspidata* into two genera. In fact in some species of Mastogloia we find a close approximation to the craticular plate by the extension of the marginal plates toward or to the center of the valve, as in M. *smithii* Thwaites,[a] a form called for that reason *Navicula biscalaris* by Brebisson.[b]

There is, however, some reason, despite the foregoing objections, for admitting the genus, namely, that true examples of Mastogloia always have, so far as I know, these marginal internal loculi and are thereby rendered widely distinct in appearance from any Navicula. As for their mode of growth, i. e., the individuals being embedded in gelatinous masses, this can not be taken into account here for the reasons mentioned under Cocconema. Besides, as Grunow points out,[c] living specimens of Mastogloia are often found without this gelatinous matrix. It seems best, on the whole, to recognize the genus subject to the foregoing remarks.

The admission of Ehrenberg's genus Pleurosiphonia as a synonym is also open to question. Most authors overlook it entirely. Thus I can find no reference to it in Cleve's extensive work on the naviculoid diatoms.[d] De Toni[e] recognizes it as a distinct genus with seven species. Ralfs,[f] though giving it a place in his classification, says: "The characters of this genus are unknown to us (they were not given by Ehrenberg till ten years later—1870); but from Ehrenberg's figure of *P. affinis* we think it is probably identical with Mastogloia." Even the diagnosis does not quite settle this doubt. There is no exact mention of marginal loculi, but of "siphons" (whence the name), on either side as lateral lines. These, which Ehrenberg states are "saepe aere repleto," are so figured in all the above citations, and in every case they are drawn as within the marginal space occupied by the loculi of Mastogloia; that is, nearer the center of the valve; and invariably as unbroken tubes, not as rows of chambered loculi, a fact emphasized in the diagnosis by the word "simplice." But no such diatoms have ever been met with. The nearest thing known is Mastogloia, and it is reasonable to suppose with Ralfs that Ehrenberg was dealing with specimens of Mastogloia. Pleurosiphonia appears in literature three years prior to the making of Mastogloia; that, is in 1853. But this is without figure or description, a nomen nudum. Ehrenberg's figure precedes Thwaites's publication by two years, but the diagnosis does not occur till 1870, under the title "Nova Genera." (See citation above.) The generally recognized rule of botanists that the date of a name shall rest on its diagnosis rather than on an undescribed figure should not be used too strictly with the Diatomaceae; for, as a rule, figures are worth much more than any diagnosis, as the intricate sculpture of the diatoms, on which their genus and species depend, is possible to figure but well-nigh impossible to describe. Besides, the reason for this rule in higher plants, seed catalogues, and similar non-scientific publications, plays no part with the diatoms. I would not, therefore, as a rule, make the diagnosis the chief factor in fixing the date of a genus or species in the Diatomaceae. But in this case, where the figures are at best indefinite and the diagnosis does not appear till four years later than Thwaites's accurate figures and description, I give preference to the latter.

Mastogloia lemnisca Leud.-Fort. Mem. Soc. Emul. St. Brieuc 35. *pl. 3. f. 29.* 1879. Schmidt, Atlas *pl. 186. f. 14-15.* 1893. De Toni, Syll. Alg. **2**: 324. 1891. Cleve, Sv. Vet. Akad. Handl. **27**^{3}: 159. *pl. 2. f. 26.* 1895.

My specimen exhibits the markings of the variety represented by Schmidt's figure 14 above.

Found at station 3013H, Hawaiian Islands.

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[a] W. Smith, Synop. Brit. Diat. **2**: *pl. 54. f. 341B.* 1856.

[b] In lit. January, 1853.

[c] Verh. Zool. Bot. Ges. Wien **10**: 575. 1860.

[d] Sv. Vet. Akad. Handl. **26**^{2}: 1894; **27**^{3}: 1895.

[e] De Toni, Syll. Alg. **2**: 326. 1891.

[f] Pritch. Hist. Infus. ed. 4. 915. 1861.

GOMPHONEMA C. Ag.

Gomphonema C. Ag. Syst. Alg. 15. 1824. Pritch. Hist. Infus. ed. 4. 886. 1861. W. Smith, Synop. Brit. Diat. **1**: 77. *pl. 27–29.* 1853. Rabh. Fl. Eur. Alg. **1**: 22. 282. *f. 71.* 1864. Van Heur. Synop. 122. *pl. 23–25.* 1881; Treat. Diat. 268. *f. 58.* 1896. De Toni, Syll. Alg. **2**: 419. 1891. Brun, Diat. Alp. 33. 1880. Griff. & Henf. Micr. Dict. ed. 3. 346. *pl. 12. f. 34.* 1875. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 178. 1894, char. emend.

Meridion C. Ag. in part; Ehrenb. Infus. 208. *pl. 16. f. 3.* 1838.

Sphenosira Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 402. *pl. 3. I. f. 27. IV. f. 12.* 1843. Pritch. Hist. Infus. ed. 4. 892. 1861. Kütz. Bacill. 88. *pl. 29. f. 47.* 1844.

Sphenella Kütz. Bacill. 83. 1844.

Gomphonella Rabh. Sussw. Diat. 61. *pl. 9. f. 1–3.* 1853.

Gomphoneis Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 73. 1894.

The inadequate ground for constituting a genus—namely, the matter of its being provided with a gelatinous attachment or being free—discussed under the genus *Cocconema* Ehrenb., is responsible for some of the above synonyms. Thus Gomphonella Rabh. is the form of Gomphonema C. Ag. that is found in gelatinous masses, while Sphenella Kütz. is made up of the forms that are free. Heiberg[a] showed that both forms occur in the same species. Cleve's Gomphoneis is based on a fine line near the margin and a slight difference in the punctation of the costae. Cleve is consistent, in that he breaks up other genera, as Navicula, on just such grounds; but, as is shown under that name, the distinctions are too trivial to separate generically forms that are otherwise so nearly related. The genus Rhoicosphenia Grun. is sometimes spoken of as differing but slightly from this genus. It is much nearer to Achnanthes Bory by reason of the totally unlike valves of the frustule. Gomphonema is closer to Cocconema Ehrenb. than to any other valid genus.

Gomphonema herculeanum Ehrenb. Ber. Akad. Wiss. Berl. **1845**: 78. 1846; Mikrog. *pl. 37 A. f. 9, pl. 35 A. VII. f. 12–13.* 1854. Van Heur. Synop. *pl. 23. f. 2.* Pritch. Hist. Infus. ed. 4. 890. 1861. De Toni, Syll. Alg. **2**: 420. 1891.

Gomphoneis herculeana Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 73. 1894. Schmidt, Atlas *pl. 215. f. 4–14.* 1899; *pl. 233. f. 1–2.* 1902.

De Toni gives as reference H. L. Smith's type no. 177. Smith labels it "*Gomphonema capitatum herculaneum*" (not *herculeanum*). It is an unimportant variety of that species and does not at all resemble this one.

Found at station 3694H, Okhotsk Sea.

Gomphonema mammilla Ehrenb. Mikrog. *pl. 37. II. f. 10.* 1854; Phys. Abh. Akad. Wiss. Berl. **1870**: 56. 1871. Van Heur. Synop. *pl. 23. f. 1.* 1881. Ralfs in Pritch. Hist. Infus. ed. 4. 890. 1861.

Gomphoneis mamilla Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 73. 1894.

Gomphonema oregonicum Ehrenb. Mikrog. *pl. 37. II. f. 12–13.* 1854?

Gomphonema (oregonicum var.?) *maximum* Grun.; Van Heur. Synop. *pl. 23. f. 3.* 1881.(?)

I am not satisfied of the specific identity of Ehrenberg's *G. mammilla* and *G. oregonicum*. As Ralfs points out, there are some considerable differences. It is, however, doubtful if they can be held separate. I do not agree with De Toni in looking upon all the above as synonymous with *G. herculeanum* Ehrenb. It should be here noted that the figure of Van Heurck is misleading in having an unsymmetrical curvature of the costae on opposite sides of the median line.

Found at station 2882, off Oregon.

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[a] Heib. Krit. Overs. Danske Diat. 1863.

COCCONEMA Hemp. & Ehrenb.

Cocconema Hemp. & Ehrenb. in Ehrenb. Symb. Phys. Evertebr. 9. *pl. 2. IV. f. 10.* 1828. Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1829**: 15. 1830; Infus. 223. *pl. 19. f. 7.* 1838; Mikrog. *pl. 10. I. f. 18.* 1854. Kütz. Bacill. 80. *pl. 6. f. 1.* 1844. Pritch. Hist. Infus. ed. 3. 877. *pl. 10. f. 194–198.* 1861. Hass. Hist. Brit. Alg. **1**: 425. *pl. 101. f. 1.* 1845. Schmidt, Atlas *pl. 10. f. 1–35.* 1875. W. Smith, Synop. Brit. Diat. **1**: 75. *pl. 23. f. 219.* 1853. Grun. Denkschr. Akad. Wien **48**^{2}: 97. *pl. 1. f. 8.* 1884. Griff. & Henf. Micr. Dict. ed. 3. 180. *pl. 12. f. 19–20.* 1875. H. L. Smith, Sp. Diat. Typ. no. 80–85. 1874. Wolle, Diat. N. A. *pl. 6. f. 1–5. 8–9, 11, 14.* 1890

Bacillaria Gmel. in part; Hemp. & Ehrenb. in Ehrenb. Symb. Phys. *pl. 2. IV. f. 10.* 1828.

Cymbella C. Ag. Consp. 1. 1830. Kütz. Bacill. 79. *pl. 6. f. 11.* 1844. Rabh. Fl. Eur. Alg. **1**: 10, 77. *f. 20.* 1864. Brun. Diat. Alp. 55. *pl. 3. f. 1–8, 10–19.* 1880. Van Heur. Synop. 59. *pl. 2. f. 1–19.* 1881. Truan, Anal. Soc. Espan. Hist. Nat. **13**: 336. *pl. 7. f. 5–12.* 1884. W. Smith, Synop. Brit. Diat. **2**: 84. 1856. Pritch. Hist. Infus. ed. 4. 875. *pl. 7. f. 45–46.* 1861. H. L. Smith, Sp. Diat. Typ. no. 115–123. 1874. H. L. Smith, The Lens **1**: 76. 1872. Greg. Quart. Journ. Micr. Sci. **3**: 4. *pl. 1. f. 17–21.* 1856. De Toni, Syll. Alg. **2**: 349. 1891. Wolle, Diat. N. A. *pl. 7. f. 1–35.* 1890. Cleve, Sv. Vet. Akad. Handl. **26**^{3}: 156. 1894. Heib. Krit. Overs. Danske Diat. 107. 1863.

Gomphonema Ag., in part; C. Ag. Consp. 33. 1830. Kütz. Linnaea **8**: 564. *pl. 4. f. 52.* 1833.

Frustulia Ag. in part; Kütz. Linnaea **8**: *f. 10.* 1833. Menegh. in Kütz. Sp. Alg. 59. 1849.

Encyonema Kütz. Linnaea **8**: 589. *f. 73.* 1833. Rabh. Fl. Eur. Alg. **1**: 11, 85. *f. 23.* 1864. Van Heur. Synop. 65. *pl. 3. f. 9–23.* 1881. Kütz. Bacill. 82. *pl. 22. f. 1.* 1844. Pritch. Hist. Infus. ed. 4. 879. *pl. 7. f. 49, pl. 14. f. 22.* 1861. W. Smith, Synop. Brit. Diat. **2**: 67. *pl. 54. f. 345.* 1856. Schmidt, Atlas *pl. 10. f. 42–66.* 1875. Hass. Hist. Brit. Alg. **2**: 439. *pl. 100. f. 10.* 1845. De Toni, Syll. Alg. **2**: 371. 1891.

Syncyclia Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1835**: 174. 1837; Infus. 233. *pl. 20. f. 11.* 1838. Kütz. Bacill. 81. *pl. 22. f. 2.* 1844. Pritch. Hist. Infus. ed. 4. 879. *pl. 7. f. 53, pl. 10. f. 206.* 1861. Rabh. Fl. Eur. Alg. **1**: 11, 97. *f. 24.* 1864. Griff. & Henf. Micr. Dict. ed. 3. 759. *pl. 14. f. 14.* 1875. De Toni, Syll. Alg. **2**: 375. 1891.

Navicula Bory, in part; Ehrenb. Infus. 184. *pl. 13. f. 18.* 1838.

Cymbophora Breb. in part; Breb. & God. Consid. Diat. 14. 1838 (cf. Van Heur. Synop. *pl. 3. f. 19.* 1881).

Pinnularia Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 133, in part; Mikrog. *pl. 5. II. f. 11.* 1854.

The claim of Heiberg [a] that Cocconema and Cymbella should be united is quite generally conceded. They differ solely in that the former grows attached to a gelatinous stipe. This is, of course, as truly a morphological characteristic as anything connected with the siliceous frustule. But to admit such a distinction is impossible in this group of plants. Even in living forms Cocconema is certain to become detached in large masses from the stipes; and when found in that condition, it is manifestly absurd to attempt a distinction. In fossil forms all question of gelatinous connections must plainly be eliminated. In the same way diatoms are Schizonema C. Ag. while in their gelatinous tubes, but clearly Navicula Bory when set free; and Eunotia Ehrenb. is identical with Himantidium Ehrenb. when the latter is out of its gelatinous investment. But in the selection of a generic name Heiberg, for utterly trivial reasons, passed over the older name Cocconema and chose Cymbella, and his selection has been generally followed. The older name is, therefore, here restored and Cymbella made its synonym. In the case of Encyonema Kütz., whose mode of growth is different from the other two, the frustule being inclosed in gelatinous tubes, its union here is more open to question; for aside from its mode of growth, which may be neglected, it offers a general distinction in having its raphe stop short of the apices of the frustule and in its terminations being peculiarly bent. But these qualities are very inconstant, and by an examination of many species it is made certain that no distinction is possible between it and the members of the genus Cocconema. Syncyclia Ehrenb. is even more strikingly dissimilar in its mode of growth, the frustules being embedded in gelatinous masses and grouping themselves therein by division into cylindrical communities, whence the name. So far as the figures are concerned, they also show some dissimilarity from the present genus in their strongly truncate ends,[a] but this must be looked upon as of little significance when we compare them with the drawings of the evident Cocconema[b] in Pritchard. It is, therefore, best to ignore in the foregoing four genera their differences of attachment and unite them in a single genus.

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[a] Heib. Krit. Overs. Dansk. Diat. 107. 1863.

Cocconema inaequale (Ehrenb.) Mann.

Navicula inaequalis Ehrenb. Ber. Akad. Wiss. Berl. **1836**: 53. 1837, nom. nud.; Infus. 184. *pl. 13. f. 18.* 1838.

Cymbella ehrenbergii Kütz. Bacill. 79. *pl. 6. f. 11.* 1844. Pritch. Hist. Infus. ed. 4. 875. *pl. 7. f. 46, pl. 9. f. 154A.* 1861. Schmidt, Atlas *pl. 9. f. 6–9, 16–18, pl. 71. f. 74, 80.* 1875. Griff. & Henf. Micr. Dict. ed. 3. *pl. 13. f. 31.* 1875. W. Smith, Synop. Brit. Diat. **1**: 17. *pl. 2. f. 21.* 1853. Van Heur. Synop. 60. *pl. 2. f. 1–2.* 1881. H. L. Smith, Sp. Diat. Typ. no. 117. 1874. Brun, Diat. Alp. 59. *pl. 2. f. 30.* 1880. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 165. 1894. De Toni, Syll. Alg. **2**: 349. 1891. Wolle, Diat. N. A. *pl. 7. f. 3, 21, 25.* 1890.

Stauroneis inaequalis Ehrenb. Mikrog. *pl. 16. I. f. 6.* 1854.

Pinnularia inaequalis Ehrenb. Mikrog. *pl. 16. II. f. 6.* 1854.

Cymbella delicata Schmidt, Atlas *pl. 9. f. 17.* 1875.

Kützing recognizes the identity of his form and Ehrenberg's *Navicula inaequalis*. It is possible *Stauroneis inaequalis* Ehrenb. and *Pinnularia inaequalis* Ehrenb. can be assigned to some other species as well as to this, as their exact character is rather hard to determine. But they agree fairly well with this species; and it is probable Ehrenberg looks upon them as the same, as he uses the three generic names interchangeably. In fact, the name Stauroneis Ehrenb.[c] is probably a misprint, for the form shows no trace of a stauros.

Found at station 3013H, Hawaiian Islands.

Cocconema kamtschatica (Grun.) Mann.

Cymbella kamtschatica Grun.; Schmidt, Atlas *pl. 10. f. 31.* 1875. Wolle, Diat. N. A. *pl. 7. f. 11.* 1890. Möll. types 3, 2, 10.

Cleve[d] makes this a variety of *Cocconema mexicanum* Ehrenb.[e] De Toni,[f] on the other hand, places it as a variety of *Cymbella gastroides* Kütz. Both of these resemble the above. In fact, few species of this genus have hard and fast boundaries; and we might add to the above resembling forms *Cymbella maculata* Kütz., especially as figured by Van Heurck.[g] I, however, think that Grunow's form, on account of its smaller size than in the above, its finer markings, its blunt apices, and its breadth at the middle of the valve, together with its tumid outline on the ventral side, can be safely left in a species by itself.

Found at station 2882, off Oregon.

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[a] Cf. Pritch. Hist. Infus. ed. 4. *pl. 7. f. 53.* 1861.

[b] Pritch. op. cit. *pl. 14. f. 18–20.*

[c] Ehrenb. Mikrog. *pl. 16. I. f. 6.* 1854.

[d] Sv. Vet. Akad. Handl. **26**: 177. 1894.

[e] Cf. Ber. Akad. Wiss. Berl. **1844**: 342. 1845. Ehrenb. Mikrog. *pl. 33. VII. f. 6–7.* 1854. Schmidt, Atlas *pl. 10. f. 32–33, pl. 71. f. 82.* 1875–81.

[f] De Toni, Syll. Alg. **2**: 362. 1891.

[g] Synop. *pl. 2. f. 16.* 1881.

Cocconema lanceolatum (C. Ag.) Ehrenb. Infus. 224. *pl. 19. f. 6.* 1838; Mikrog. *pl. 8. I. f. 8, pl. 10. I. f. 18, pl. 14. f. 82, pl. 15A. f. 96, pl. 17. II. f. 32, pl. 38A. II. f. 10, pl. 39. II. f. 16.* 1854. Schmidt, Atlas *pl. 10. f. 8–10.* 1875; *pl. 72. f. 22–25.* 1881. H. L. Smith, Sp. Diat. Typ. no. 83. 1874. Hass. Hist. Brit. Alg. 426. *pl. 101. f. 1.* 1845. Pritch. Hist. Infus. ed. 4. 877. *pl. 10. f. 194–195.* 1861. Kütz. Bacill. 81. *pl. 6. f. 3.* 1844. Rabh. Fl. Eur. Alg. **1:** 83. 1864. W. Smith, Synop. Brit. Diat. **1:** 75. *pl. 23. f. 219.* 1853. Griff. & Henf. Micr. Dict. 180. *pl. 12. f. 19–20.* 1875. W. Smith, Ann. Mag. Nat. Hist. II. **19:** 8. *pl. 1. f. 8* (not *f. 7*). 1857. Thw. Ann. Mag. Nat. Hist. **20:** 343. *pl. 22. f. C, 1–3.* 1847. Wolle, Diat. N. A. *pl. 6. f. 1–3, 11, 14–16.* 1890.

Gomphonema lanceolatum C. Ag. Consp. Diat. 34. 1830. Kütz. Linnaea **8:** 38. 1833 (not *G. lanceolatum* Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 306. *pl. 2. I. f. 37.* 1843).

Cocconema asperum Ehrenb. Ber. Akad. Wiss. Berl. **1840:** 206. 1841; Mikrog. *pl. 5. I. f. 1. II. f. 1. III. f. 27, pl. 6. I. f. 30, pl. 9. I. f. 42, pl. 16. III. f. 39.* 1854. Kütz. Bacill. 81. 1844. Pritch. Hist. Infus. ed. 4. 877. 1861. Bail. Amer. Jour. Sci. 124. *pl. 2. f. 2* (unnamed). 1838; cf. Hab. Cat. 85. 1877.

Cocconema cornutum Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 124. 1843; Mikrog. *pl. 5. II. f. 3. III. f. 28, pl. 14. f. 80, pl. 15A. f. 94, pl. 39. III. f. 12.* 1854.

Cocconema cymbiforme Ehrenb. err. det. Bail. in Fremont, Rep. Expl. Exped. 1842–4. 302. *pl. 5. f. 8* (not *f. 7, 9*). 1845.

Cymbella lanceolata Kirchn. in Cohn, Krypt. Flora Sches. 188. 1878. Brun, Diat. Alp. 57. *pl. 3. f. 19, pl. 9. f. 16.* 1880. Van Heur. Synop. 63. *pl. 2. f. 7.* 1881. Truan, Anal. Soc. Espan. Hist. Nat. **13:** 337. *pl. 7. f. 6.* 1884. De Toni, Syll. Alg. **2:** 362. 1891. Pant. Beitr. Bacill. Ung. **2:** 41. 1889; **3:** *pl. 23. f. 344, 350.* 1893 (not *C. lanceolata* C. Ag. Consp. Diat. 9. 1830).

Cymbella aspera Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 175. 1894, in part.

Although I agree with De Toni in making *Cocconema cornutum* Ehrenb. synonymous with the present species, I recognize that there is ground for questioning this, *C. cornutum* being more suddenly attenuated on either side of the middle and, therefore, with narrower apices than *C. lanceolatum*, whence the name. But I do not think this is sufficient to separate them. I have no question in regard to *C. asperum* Ehrenb., which Cleve holds as a distinct species. Ehrenberg's own figures of this are indistinguishable from his *C. lanceolatum*. Cleve has evidently a somewhat different conception of this diatom, as is shown by his uniting with it such forms as Pantocsek's *Cymbella gigantea*,[a] which seems to me quite distinct from Ehrenberg's *C. asperum*. I therefore make Cleve's species synonymous only in part. Doubtless this species and *C. gastroides* Kütz. interlock.

Found at station 2882, off Oregon.

AMPHORA Ehrenb.

Amphora Ehrenb. Ber. Akad. Wiss. Berl. **1840:** 205. 1841. Kütz. Bacill. 107. 1844. Rabh. Fl. Eur. Alg. **1:** 86. 1864. H. L. Smith, The Lens, **2:** 64. 1873. Van Heur. Synop. 55. 1881. Brun, Diat. Alp. 53. 1880.

Navicula Ehrenb. Infus. 188. *pl. 14. f. 3.* 1838, in part.

Frustulia Agardh, in part; Kütz. Linnaea **8:** 535. 1833. Agardh, Flora **10:** 627. 1827.

Cymbella Agardh, in part; Kütz. Bacill. 80. *pl. 5. f. 8, pl. 6. f. 7.* 1844.

Cocconeis Ehrenb. in part; Neup. Math. Termesz. Közlem. **5:** *pl. 2. f. 49.* 1867

Amphora baccata Mann, sp. nov. PLATE XLIV, FIGURE 2.

Valves straight or slightly convex on the ventral side; convex by a broad, even arc on the dorsal side; ends blunt, rounded; raphe beginning somewhat toward the dorsal side of each apex, curving slightly to that side, then recurving toward the ventral side in a long, graceful arc and terminating at a small, rectangular, hyaline central area, close to the ventral side; markings of closely set, moniliform striae, transverse except toward the apices, where they are slightly incurved; beading of the striae alike on both sides of the raphe, which is bordered on each side by a narrow hyaline space; a hyaline line, the width of one row of beads, forming a narrow stauros transversely across the center, from the rectangular central area to the dorsal side.

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[a] Pant. Beitr. Bacill. Ung. **3:** *pl. 21. f. 321.* 1893.

Length of valve, 0.135 mm.; width of valve, 0.023 mm. Striae, 76 in 0.1 mm.

Type in the U. S. National Museum, no. 590153, from station 3688H, Okhotsk Sea, August 27, 1896; 1,562 fathoms, bottom of brown mud and fine sand.

There is some resemblance between the above and *A. elegans* Gregory;[a] but Gregory's species is more attenuated, especially as to the apices, and is much more delicately marked. Thus De Toni says of it,[b] "Valvis gracilibus, semilunatis, levibus (striis obsoletis)." It resembles more strongly *A. levis* Gregory,[c] a similarity which is, however, accidental to Schmidt's figure, as can be seen by comparing it with the original description and figures,[d] Gregory saying that his form is "very hyaline," and that "the striae are very fine, about 60 in 0.001, very hyaline and hardly to be seen with a power of 400 diam." Schmidt's figure is therefore quite deceptive.

Amphora crescens Mann, sp. nov. PLATE XLIV, FIGURE 3.

Amphora crassa punctata Grun.? Schmidt, Atlas *pl. 28. f. 32*. 1875.

Valve slightly convex on the dorsal side, more rapidly curving toward the rounded and incurved ends; the margin appearing ribbed because of the transverse striae; ends bent inward into rounded wings extending beyond the ventral line of the rest of the valve and hyaline along their inner edges; raphe beginning near the ends, close to the dorsal margin, almost straight until near the middle, then curving ventrally to the two central nodules, which are distant from the ventral side one-fourth the width of the valve; ventral margin slightly convex at the center, straight or slightly concave between this and the rounded ends; transverse striae obscure, except where seen in relief along the dorsal margin; markings different on the two sides of the raphe; on the dorsal side consisting of rows of beads, three to five in a row, the smallest next to and touching the raphe, increasing regularly in size to the last at the dorsal margin; these rows alternating with the striae visible at the margin, equidistant, 44 in 0.1 mm., transverse at the center of the valve, thence outward gradually inclining toward the ends; on the ventral side the rows shorter, of two or three beads of nearly equal size, those nearest the raphe slightly larger; not touching the raphe, but uniformly distant the width of one bead, thus leaving a hyaline line along the raphe on the ventral side only; rows absent at the middle for the width of two rows, thence at first inclining from the central area, halfway to their becoming transverse, from there outward gradually inclined from the ends, thus making them at this point confluent with those on the dorsal side of the raphe; at the rounded ends of the valve the ventral rows not reaching the margin, but leaving these hyaline on their inner edges.

Length of valve, 0.09 mm.; width of valve, 0.013 mm. Beaded striae, 44 in 0.1 mm.

Type in the U. S. National Museum, no. 590158, from station 4516H, Gulf of California, December 22, 1904; 1,627 fathoms.

This species bears a significant general resemblance to the figure in Schmidt's Atlas,[e] named *A. crassa punctata* Grun. The figure is very poor, making it impossible to see whether or not there are beaded striae present, though the varietal name implies that

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[a] Trans. Micr. Soc. Lond. n. s. **5**: 70. *pl. 1. f. 30.* 1857. Moeb. Diat.-taf. *pl. 12. f. 30.* 1890.

[b] De Toni, Syll. Alg. **2**: 381. 1891.

[c] Schmidt, Atlas, *pl. 26. f. 9.* 1875.

[d] Trans. Roy. Soc. Edinb. **21**: 514. *pl. 12. f. 74, b–c.* 1857.

[e] *Pl. 28. f. 32.* 1875.

there are. At any rate, it is clear Grunow has overlooked Gregory's clear characterization of his species,[a] in which he expressly states that his former figure[b] is incorrect and probably denotes another species. He goes on to say: "The markings are entire, coarse, subdistant, about 12 in 0.001. Between the lateral segments are from five to eight converging bars, marked with the same subdistant entire striae. In one focus. not here figured, nothing is seen but bars from one side to the other, which are thus eight or nine in number." He then refers to various localities where he has found this form, showing that it is constant in its characters. If the contour of Amphora, independent of its markings, were to be considered the specific mark of distinction, then my species and the figure in Schmidt's Atlas[c] might be classed as broad varieties of Gregory's form; and to these would have to be added many other otherwise valid species, as this winged contour is not at all uncommon in the genus. But such is not the case; and the above, together with the figure Gregory excludes from his *crassa* in the citation already made, must rank separately. Prof. H. L. Smith in his Conspectus of Amphora,[d] correctly described and figured *A. crassa* Greg. He there favors its union with *A. sulcata* Breb., according to Grunow's suggestion, but the merits of this question do not enter into the present case, as my form is equally unlike both of these. It is certain that whatever be the interpretation of Schmidt's blurred figure, the specimen here named and figured can not be referred to Gregory's *A. crassa*.

Amphora honshuensis Mann, sp. nov. PLATE XLIV, FIGURE 1,

Valves broadly rounded, the margin on the ventral side concave and parallel to the convex dorsal margin, until, near the ends, they both converge to form the broad, rounded apices; raphe beginning at the center, close to the ventral margin, curving sharply backward toward the dorsal side and terminating in two large beads close to the dorsal margin, but some distance from the rounded apices; striae of very fine beading, extending from the dorsal and ventral margins to the raphe, leaving no hyaline band on either side of it; a small lunate, hyaline area between the two central nodules of the raphe and the ventral margin; valve depressed at the center in a broad shallow transverse hollow, the two halves on either side rising above this like lobes; on account of this central depression and the elevation of the two halves the lines of beading on the dorsal side of the raphe, although approximately transverse, appearing in the hollow to bend convexly from each other, then halfway toward the ends to become transverse, and near the broad, rounded extremities to again become curved with the concave curvature inward; on the ventral side of the raphe the lines of beading, which are equally minute, beginning at the hyaline lunate area before mentioned, somewhat inclined toward the center and transverse only on nearing the rounded ends; these lines on the ventral side somewhat irregular, producing a wavy appearance; valves very delicate and diaphanous. Name referring to proximity to Honshu Island, Japan.

Length of valve, 0.16 mm.; width of valve, 0.04 mm. Striae, 85 to 88 in 0.1 mm.

Type in the U. S. National Museum, no. 590154, from station 3698, off Honshu Island, Japan, May 5, 1900; 153 fathoms, bottom of green mud, volcanic ashes, and sand.

Amphora mexicana Schmidt, Atlas *pl. 27. f. 47–48* (not *f. 49*). 1875. De Toni, Syll. Alg. **2**: 409. 1891. Cleve, Sv. Vet. Akad. Handl. **26**^{2}: 105. *pl. 4. f. 15.* 1895.

Amphora wachenhusenii Jan.; Schmidt, Atlas *pl. 40. f. 38.* 1876. Diat. Gaz. Exped. *pl. 22. f. 47.*

Amphora boryana Pant. Bacill. Ung. **2**: 36. 1889; **3**: *pl. 38. f. 531.* 1893.

There is no appreciable difference between the above. It may also be that *A. oculus* Schmidt[e] should be added to the synonyms; although the absence of the curved expansions on the ventral side of the raphe in *A. oculus* and its more massive build make this union doubtful. It is so united by Fricke.[a] *A. proteus kariana* Grun.,[b] has also a strong resemblance to the above. I see no reason for uniting with these, under the general name *A. oculus* Schmidt, the quite different *A. farcimen* Grun., *A. weissflogii* Schmidt, and *A. kamorthensis* Grun., as seems to be done by Fricke.[c] It may be said that Cleve[d] also unites *A. boryana* Pant. with the above, and De Toni[e] includes it as variety *boryana*, but with a question mark.

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[a] Trans. Roy. Soc. Edinb. **21**: 524. *pl. 14. f. 94a–d.* 1857.

[b] Trans. Micr. Soc. Lond. n. s. **5**: *pl. 1. f. 35.* 1857.

[c] *Pl. 28. f. 32.* 1875.

[d] The Lens **2**: 76. *pl. 2. f. 5.* 1873.

[e] Schmidt, Atlas *pl. 27. f. 52.* 1875.

My specimens agree best with Cleve's figure,[f] though they are smaller forms, their average length being 0.079 mm. and their width 0.023 mm. I look upon the diatom figured in Schmidt's Atlas[g] bearing the above name, as a quite distinct species.

Found at stations 3698, 3712H, off Honshu Island and in Okhotsk Sea.

Amphora pellucida Greg. Trans. Roy. Soc. Edinb. **21**: 513. *pl. 12. f. 73.* 1857. Schmidt, Atlas *pl. 27. f. 11, 36–37, 65.* 1875. H. L. Smith, The Lens **2**: 78. *pl. 2. f. 15.* 1873. De Toni, Syll. Alg. **2**: 405. 1891.

It is possible this is a delicate variety of *A. ovalis* Kütz., as treated by Rabenhorst,[h] a view also seemingly favored by H. L. Smith and De Toni above. Cleve[i] says it is "too imperfectly described and figured for admitting of identification" (which is not the case); and then he proceeds to identify it by putting it in *A. marina* (W. Smith?) Van Heur. Again[j] he places it, as figured in Schmidt's Atlas at above reference, exclusive of figure 65, in *A. commutata* Grun. If it is to be included in any other species, it should be in *A. ovalis* Kütz., but I think there is sufficient doubt about this to justify its being allowed to stand.

Found at station 2920H, Hawaiian Islands.

Amphora spectabilis Greg. Trans. Roy. Soc. Edinb. **21**: 516. *pl. 13. f. 80a, d, e* (not *f. 80b, c*). Schmidt, Atlas *pl. 40. f. 20–23.* 1876. H. L. Smith, The Lens **2**: 80. *pl. 3. f. 3.* 1873. Cleve, in Nordensk. Vega Exped. **3**: 462. 1883; Sv. Vet. Akad. Handl. **27**^{3}: 132. 1895. De Toni, Syll. Alg. **2**: 408. 1891.

Amphora furcata Leud.-Fort. Mem. Soc. Emul. St. Brieuc 20. *pl. 1. f. 11.* 1879. De Toni, Syll. Alg. **2**: 402. 1891.

The claim made by Leuduger-Fortmorel, above, that Schmidt's figures, above, are not Gregory's *spectabilis*, but a distinct species, which he also figures and to which he gives the specific name *furcata*, is supported by De Toni, above. I do not agree with this view, but take the position stated by Cleve[k] that Schmidt's and Leuduger-Fortmorel's forms are only a variety of Gregory's species. A careful reading of Gregory's long description of this diatom will make it evident that the only particular in which it fails to correspond with Schmidt's figures is in the forking of the inner ends of the striae on the dorsal side. Gregory says his specimens were very dimly striated on that side, so much so that though the striae were evident near the dorsal margin, they faded away toward the inner ends. Without doubt this fact prevented his noting the forking of these striae; though it ought to be added that this forking is by no means invariable, as is to be seen by comparing Schmidt's figure 20 with his figure 21. So far as my experience goes, the figure of Leuduger-Fortmorel seems overdrawn in the irregularity of the striae.

Found at station 3698, off Honshu Island, Japan.

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[a] Fricke, Verzeichniss zu Schmidt's Atlas 10. 1902.

[b] Cleve & Grunow, Sv. Vet. Akad. Handl. **17**^{2}: 24. *pl. 1. f. 7.* 1880.

[c] Cleve. Sv. Vet.-Akad. Handl. **27**^{3}: 105. 1895.

[d] Op. cit. 8.

[e] Syll. Alg. **2**: 409. 1891.

[f] Op. cit. *pl. 4. f. 15.*

[g] *Pl. 27. f. 49.* 1875.

[h] Fl. Eur. Alg. 1: 92. 1864.

[i] Cleve, op. cit. 103.

[j] Cleve, op. cit. 119.

[k] Cleve, op. cit. 132.

CYSTOPLEURA Breb.

Cystopleura Breb.; Kütz. Sp. Alg. 3. 1849, as synonym. Kuntze, Rev. Gen. Pl. **2**: 890. 1891

Frustulia C. Ag. in part; Kütz, Linnaea **8**: 16. *pl. 1. f. 18.* 1833.

Eunotia Ehrenb. Infus. 190. *pl. 14. f. 5.* 1838, in part.

Navicula Bory, in part; Ehrenb. Infus. 184. *pl. 13. f. 19.* 1838.

Epithemia Kütz. Bacill. 33. 1844. Rabh. Fl. Eur. Alg. **1**: 9, 62. *f. 15.* 1864. W. Smith, Synop. Brit. Diat. **1**: 11. *pl. 1. f. 1.* 1853. Brun, Diat. Alp. 42. *pl. 2. f. 10–18.* 1880. Van Heur. Synop. 138. *pl. 31–32.* 1881. H. L. Smith, The Lens **1**: 80. 1872. Pritch. Hist. Infus. ed. 4. 759. *pl. 12. f. 24–25.* 1861. Eng. & Pr. Pflanzenfam. **1**^{1b}: 140. *f. 256.* 1896, not Blume, 1826.

Cymbella Hass. Hist. Brit. Alg. **1**: 428. *pl. 100. f. 7–8.* 1845, in part, not C. Ag.

The name Epithemia Breb. is a homonym of Epithemia Blume, 1826, a genus of the Primulaceae. The genus Cystopleura Breb. is first technically published by Kuntze, all previous references to it being in synonomy.

Cystopleura gibba (Ehrenb.) Kuntze, Rev. Gen. Pl. **2**: 891. 1891. De Toni, Syll. Alg. **2**: 780. 1892.

Navicula gibba Ehrenb. Infus. 184. *pl. 13. f. 19.* 1838.

Eunotia gibba Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 3. *pl. I. f. 39.* 1843. Bail. in Fremont, Rep. Explor. Exped. 1842–4. 302. *pl. 5. f. 4–5.* 1845.

Eunotia jastrabensis Ehrenb. Mikrog. *pl. 8. f. 3.* 1854.

Epithemia gibba Kütz. Bacill. 35. *pl. 4. f. 22.* 1844. W. Smith, Synop. Brit. Diat. **1**: 15. *pl. 1. f. 13.* 1853. Rabh. Sussw. Diat. *pl. 1. f. 3.* 1853. Grun. Verh. Zool. Bot. Ges. Wien **12**: 327. *pl. 6. f. 7.* 1862. Pritch. Hist. Infus. ed. 4. 759. *pl. 12. f. 27.* 1861. Brun, Diat. Alp. 44. *pl. 2. f. 14.* 1880. Van Heur. Synop. 139. *pl. 32. f. 1–5.* 1881. H. L. Smith, Sp. Diat. Typ. no. 150. 1874. Wolle, Diat. N. A. *pl. 35. f. 1–3, 8–9.* 1890. Thwaites, Ann. Mag. Nat. Hist. **20**: 344. *pl. 22. f. F1–2.* 1847. Griff. & Henf. Micr. Dict. ed. 3. 287. *pl. 51. f. 6.* 1875. Van Heur. Treat. Diat. 296. *pl. 9. f. 351–354.* 1896. Grun. Denkschr. Akad. Wien **48**^{2}: 100. 1884.

Epithemia ventricosa Kütz. Bacill. 35. *pl. 30. f. 9.* 1844. W. Smith, Synop. Brit. Diat. **1**: 15. *pl. 1. f. 14.* 1853.

It is impossible to unite with this species Ehrenberg's *Navicula uncinata*,[a] though subsequent to its publication he refers to it in this connection.[b] Without a figure and more accurate description there is nothing gained by placing this name in the synonymy.

The specimens from station 3346 are a variety in which hardly a trace of the granulation of the striae is visible.

Found at stations 2690H, 2848, 2917H, 3013H, 3346, Bering Sea to central California and Hawaiian Islands.

Cystopleura turgida Kuntze, Rev. Gen. Pl. **2**: 891. 1891. De Toni, Syll. Alg. **2**: 777, 1892.

Navicula turgida Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1830**: 64. 1831.

Navicula granulata Ehrenb.; Poggend. Annal. Phys. u. Chem. **38**: 220. *pl. 3. f. 2.* 1836.

Eunotia turgida Ehrenb. Infus. 190. *pl. 14. f. 5, pl. 21. f. 20a.* 1838.

Eunotia westermani Ehrenb. Infus. 190. *pl. 14. f. 6.* 1838.

Eunotia granulata Ehrenb. Infus. 191. *pl. 21. f. 20.* 1838. Kütz. Bacill. 36. 1844.

Eunotia faba Ehrenb. Infus. 191. *pl. 21. f. 21.* 1838.

Eunotia librile Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 126. *pl. 3. I. f. 38.* 1843.

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[a] Phys. Abh. Akad. Wiss. Berl. **1828**: 64. 1830.

[b] Ehrenb. Infus. 184. 1838.

Epithemia turgida Kütz. Bacill. 34. *pl. 5. f. 14.* 1844. Rabh. Fl. Eur. Alg. **1**: 62. 1864. Rabh. Süssw. Diat. 18. *pl. 1. f. 11.* 1853. W. Smith, Synop. Brit. Diat. **1**: 12. *pl. 1. f. 2.* 1853. Pritch. Hist. Infus. ed. 4. 761. *pl. 4. f. 1, pl. 9. f. 156–161, pl. 11. f. 1–8.* 1861. H. L. Smith, Sp. Diat. Typ. no. 155. 1874. Brun, Diat. Alp. 43. *pl. 2. f. 17.* 1880. Van Heur. Synop. *pl. 31. f. 1–2, 5–7.* 1881. Grun. Verh. Zool. Bot. Ges. Wien **12**: 324. *pl. 6. f. 2.* 1862.

Epithemia westermanii Kütz. Bacill. *pl. 30. f. 4.* 1844 (not *pl. 5. f. 13;* not W. Smith, Synop. Brit. Diat. **1**: 14. *pl. 1. f. 11.* 1853; not H. L. Smith, Sp. Diat. Typ. no. 157. 1874; not Pritch. Hist. Infus. ed. 4. 760. *pl. 4. f. 2, pl. 9. f. 157.* 1861). Van. Heur. Synop. *pl. 31. f. 8.* 1881.

Epithemia librile Kütz. Bacill. 35. *pl. 29. f. 45* (poor). 1844. Pritch. Hist. Infus. ed. 4. 761. *pl. 12. f. 24–25.* 1861.

Epithemia vertagus Kütz. Bacill. 36. *pl. 30. f. 20.* 1844?

Epithemia granulata Kütz. Bacill. 35. *pl. 5. f. 20.* 1844. Pritch. Hist. Infus. ed. 4. 761. *pl. 9. f. 165.* 1861.

Epithemia faba Kütz. Bacill. 36. *pl. 5. f. 21.* 1844.

Cymbella turgida Hass. Hist. Brit. Alg. **1**: 428. *pl. 100. f. 7.* 1845.

It is doubtful if *E. westermanii* (Ehrenb.) Kütz., included above, should be attributed to Kützing. His first figure and description represent a totally different diatom, as do some of the subsequent copies of it and exsiccati so determined and cited above, which I have also excluded. The figure on plate 30 is, however, a good representation of this species, as is that cited by Van Heurck. There is very close similarity between the present species and *E. hyndmanii* W. Smith,[a] so much so that their separation, though upheld by De Toni and others, appears to me decidedly doubtful. In fact, my specimen is about midway between the two, having the strongly bowed dorsal outline and broad rounded apices of *E. hyndmannii* together with the beading of *E. turgida*, especially the large beading along the ventral margin as seen in the zonal view.

Found at station 2882, off Oregon.

NITZSCHIA Hass.

Nitzschia Hass. Hist. Brit. Alg. **1**: 435. 1845. W. Smith, Synop. Brit. Diat. **1**: 37. *pl. 13–14.* 1853. Cleve & Grun. Sv. Vet. Akad. Handl. **17**^{2}: 67. 1880. Van Heur. Synop. 169. *pl. 57–70.* 1881; Treat. Diat. 382. *pl. 15–16.* 1896. Pritch. Hist. Infus. ed. 4. 779. 1861. De Toni, Syll. Alg. **2**: 495. Eng. & Pr. Pflanzenfam. **1**^{1b}: 142. 1896.

Navicula Bory, in part; Ehrenb. Infus. 182. *pl. 13. f. 15.* 1838.

Synedra Ehrenb. in part; Kütz. Bacill. 67. *pl. 4. f. 36–37.* 1844.

Surirella Turp. in part; Bail. Smithson. Contr. Knowl. **2**^{8}: 40. *pl. 2. f. 36.* 1851.

Amphipleura Kütz. in part; W. Smith, Synop. Brit. Diat. **1**: 45. *pl. 15. f. 128.* 1853.

Tryblionella W. Smith, Synop. Brit. Diat. **1**: 35. 1853.

Denticula Kütz. in part; W. Smith, Synop. Brit. Diat. **2**: 21. *pl. 34. f. 295.* 1856.

Dimeregramma Ralfs, in part; Pritch. Hist. Infus. ed. 4. 790. *pl. 4. f. 12.* 1861.

Nitzschiella Rabh. Fl. Eur. Alg. **1**: 163. 1864.

Grunowia Rabh. Fl. Eur. Alg. **1**: 146. 1864.

Pritchardia Rabh. Fl. Eur. Alg. **1**: 162. 1864.

Perrya Kitton, Mo. Micr. Journ. **12**: 218. *pl. 81. f. 1–3.* 1874.

Bacillaria Gmel. in part; De Toni, Syll. Alg. **2**: 493. 1891.

Hantzschia Grun. in Cleve & Grun. Sv. Vet. Akad. Handl. **17**^{2}: 103. 1880. Van Heur. Synop. 168. *pl. 56.* 1881; Treat. Diat. 280. 1896.

The original genus of Hassall was extensively emended by William Smith in 1853 and by Grunow in 1880. In the latter instance the genus Hantzschia was set off by

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[a] W. Smith, Synop. Brit. Diat. **1**: 12. *pl. 1. f. 1.* 1853, and Van. Heur. Synop. *pl. 31. f. 3–4.* 1881.

Grunow, but on too unimportant distinctions. The rather sharp constriction of the valves at the center on the dorsal side, and especially the heavier beading of the dorsal margin, sometimes extending as ridges part way across the valve, are the marks of distinction. The apices are liable to be slightly curved ventrally. These characters of Hantzschia singly or together are more or less to be seen in other species of Nitzschia, and are not good generic marks. Van Heurck retains the genus. It is instructive on this point to compare *Nitzschia bilobata* W. Smith with *Hantzschia amphioxys* (Ehrenb.) Grun.[a]

Nitzschia amphibia Grun. Verh. Zool.-Bot. Ges. Wien **12:** 574. *pl. 12. f. 23.* 1862. Cleve, Sv. Vet. Akad. Handl. **17^2:** 98. 1880. Van Heur. Synop. 184. *pl. 68. f. 15–17.* 1881–85. Rabh. Fl. Eur. Alg. **1:** 157. 1864. H. L. Smith, Sp. Diat. Typ. no. 688. 1874. De Toni, Syll. Alg. **2:** 543. 1891.

Bacillaria frauenfeldii Grun. Verh. Zool. Bot. Ges. Wien **10:** 584. *pl. 12. f. 1.* 1862. De Toni, Syll. Alg. **2:** 545. 1891.

Nitzschia frauenfeldii Grun. in Cleve & Grun. Sv. Vet. Akad. Handl. **17^2:** 98. 1880. Van Heur. Synop. *pl. 68. f. 18.* 1881.

Nitzschia actiuscula Grun.; Van Heur. Synop. *pl. 68. f. 19–23.* 1881.

Although the original figures of *B. frauenfeldii* are much more tapering than those of *N. amphibia*, a comparison of the two as figured by Van Heurck will show their identity. In fact, Grunow says:[b] "Nahe verwandt mit *N. amphibia* und wohl nur eine langere Form derselben." The species is also too close to some other forms, as *N. fossilis* Grun.[c] and *N. liebetruthii* Rabh.[d] The former differs merely in much greater attenuation, but as I have not seen the diatom I do not include it with the above.

Found at station 3091, off Oregon.

Nitzschia angustata (W. Smith) Grun. in Cleve & Grun. Sv. Vet. Akad. Handl. **17^2:** 70. 1880. Van Heur. Synop. 172. *pl. 57. f. 22–24.* 1881. Cleve & Möll. typ. no. 154–155. De Toni, Syll. Alg. **2:** 500. Van Heur. Treat. Diat. 385. *pl. 15. f. 498.* 1896.

Tryblionella angustata W. Smith, Synop. Brit. Diat. **1:** 36. *pl. 30. f. 262.* 1853. Rabh. Fl. Eur. Alg. **1:** 148. 1864. Pritch. Hist. Infus. ed. 4. 792. 1861. Brun, Diat. Alp. 103. *pl. 4. f. 28.* 1880.

Nitzschia marina Grun. in Cleve & Grun. Sv. Vet. Akad. Handl. **17^2:** 70. 1880. Van Heur. Synop. *pl. 57. f. 26–27.* 1881. De Toni, Syll. Alg. **2:** 500. 1891. Cleve in Nordensk. Vega Exped. **3:** 507. 1883. Wolle, Diat. N. A. *pl. 44. f. 16* (not *f. 17*). 1892.

Both Brun and Habirshaw add to the above list *Tryblionella acuminata* W. Smith.[e] This is incorrect. Nor can Habirshaw's union of *Synedra praemorsa* Ehrenb.[f] be admitted. The measurements of *N. marina* vary considerably in the first and fourth citations above, the latter being much larger.

Found at stations 2929, 4516H, off southern California and in Gulf of California.

Nitzschia insignis Greg. Trans. Micr. Soc. Lond. n. s. **5:** 80. *pl. 1. f. 46, 46**. 1857. Van Heur. Synop. *pl. 61. f. 1.* 1881; Treat. Diat. 391. *pl. 32. f. 835, 836.* 1896. Cleve & Grun. Sv. Vet. Akad. Handl. **17^2:** 83. 1880. De Toni, Syll. Alg. **2:** 521. 1892 (not H. L. Smith, Sp. Diat. Typ. no. 349. 1874 = *N. scalaris* (Ehrenb.) W. Smith).

Pritchardia insignis Rabh. Fl. Eur. Alg. **1:** 163. 1864.

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[a] Van Heur. Treat. Diat. *pl. 15. f. 484b, 513.* 1896.

[b] Sv. Vet. Akad. Handl. **17^2:** 99. 1880.

[c] Van Heur. Synop. *pl. 68. f. 24.* 1881.

[d] Van Heur. Synop. *pl. 68. f. 25–26.* 1881.

[e] W. Smith, Synop. Brit. Diat. **1:** 36. *pl. 10. f. 77.* 1853.

[f] Phys. Abh. Akad. Wiss. Berl. **1841:** *pl. 3. VI. f. 11.* 1843.

Nitzschia smithii Ralfs in Pritch. Hist. Infus. ed. 4. 781. Cleve & Grun. Sv. Vet. Akad. Handl. 17^{2}: 84. 1880. Grun. Verh. Zool. Bot. Ges. Wien **12**: 564. 1862. De Toni, Syll. Alg. **2**: 521. 1892. Van Heur. Synop. *pl. 61. f. 4.* 1881.

Pritchardia smithii Rabh. Fl. Eur. Alg. **1**: 163. 1864.

Nitzschia spectabilis W. Smith, Synop. Brit. Diat. **1**: 39. *pl. 14. f. 116.* 1853 (not Ehrenb.).

Nitzschia insignis marginifera Grun. in Cleve & Grun. Sv. Vet. Akad. Handl. 17^{2}: 84. *pl. 6. f. 105.* 1880?

Ralfs changed William Smith's name *N. spectabilis* to *N. smithii* because of the *N. spectabilis* of Ehrenberg. There is no difference between this and *N. insignis*, the sigmoid shape of the frustules in *N. smithii* being a vanishing quantity in many cases and of no specific importance when present. As Grunow saw only the zonal view of the last-named synonym above, it remains doubtful whether it was this or *N. scalaris* (Ehrenb.) W. Smith. H. L. Smith's type referred to above is misnamed, being a true *N. scalaris* and identical with his type no. 365, except that it is a little smaller. The two species which Van Heurck considers as possible varieties of *N. insignis*,[a] namely, *N. adriatica* Grun.,[b] and *N.* (*adriatica* var. ?) *spathulifera* Grun.[c] are rather varieties of *N. scalaris*. It is more difficult to include with *N. scalaris* *N.* (*insignis* var. ?) *notabilis* Grun., which Grunow[b] makes an unquestioned variety of the present species. It is certain it does not belong here.

Found at station 2823, Gulf of California.

Nitzschia panduriformis Greg. Trans. Roy. Soc. Edinb. **21**: 529. *pl. 14. f. 102.* 1857. Van Heur. Synop. 172. *pl. 58. f. 1–4* (*f. 5–6* doubtful). 1881. Cleve, Bih. Sv. Vet. Akad. Handl. 1^{11}: 12. 1873. Cleve & Grun. Sv. Vet. Akad. Handl. 17^{2}: 71. (*pl. 5. f. 92 ?*). 1880. De Toni, Syll. Alg. **2**: 501. 1892. Van Heur. Treat. Diat. 386. *pl. 15. f. 500.* 1896. Wolle, Diat. N. A. *pl. 44. f. 3–4, 9.* 1890. Pritch. Hist. Infus. ed. 4. 780. 1861.

Tryblionella lata Witt, Journ. Mus. Godef. **1**: 66. *pl. 8. f. 6.* 1873. Lagers. Bih. Sv. Vet. Akad. Handl. 3^{15}: 27. *pl. 1. f. 2.* 1876.

Nitzschia lata Cleve, Bih. Sv. Vet. Akad. Handl. 5^{8}: 12. 1878.

Witt's *T. lata* is a very much more finely marked variety than the type, otherwise quite typical; the form of it which Lagerstedt calls "var. *elegans*" stands midway between it and the type. His superb figure is, like all his figures in the same work, a good approach to the ideal in depicting the diatoms. The *N. panduriformis nicobarica* Grun.[d] does not belong to this species, but is a form of his *N. littoralis*, which in turn is a variety of *N. tryblionella* Hantzsch. There is some doubt with regard to the two forms of Van Heurck's cited above, which also correspond to Cleve's figure, their entire lack of the hyaline area, the so-called "sulcus," making them questionable. Van Heurck[e] drops them out from the above category.

Found at stations 2807, 2808, 2823, 2835, 3008H, Galapagos Islands to Gulf of California and Hawaiian Islands.

Nitzschia plana W. Smith, Synop. Brit. Diat. **1**: 42. *pl. 15. f. 114.* 1853. Van Heur. Synop. *pl. 58. f. 10–11.* 1881; Treat. Diat. 387. *pl. 15. f. 503.* 1896. De Toni, Syll. Alg. **2**: 503. 1892. Rabh. Fl. Eur. Alg. **1**: 153. 1864. Cleve & Grun. Sv. Vet. Akad. Handl. 17^{2}: 72. 1880 (not H. L. Smith, Sp. Diat. Typ. no. 363. 1874).

Nitzschia marginulata didyma Grun. in Cleve & Grun. Sv. Vet. Akad. Handl. 17^{2}: 72. 1880. Van Heur. Synop. *pl. 58. f. 14.* 1881. De Toni, Syll. Alg. **2**: 504. 1892.

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[a] Van Heur. Synop. *pl. 61. f. 2, 3.* 1881.

[b] Sv. Vet. Akad. Handl. 17^{2}: 84. 1880.

[c] Op. cit. 85.

[d] Fenzl, Reise Novara Bot. **1**: 97. *pl. 1A. f. 4.* 1870.

[e] Treat. Diat. 1896.

It is probable that the other forms of Grunow's *N. marginulata* also belong to this species. He says, regarding its relation to *N. plana*, "Aehnlich, aber mit breiterem, stets bis zu den Schaalenenden reichendem fast ganz glattem Mittelraume." The specimen found by me has the characteristics of both; it has the practically hyaline central space of Grunow's form instead of the irregularly punctate space of Smith's type, but, as in the latter, stopping short of the apices instead of extending to these, as Grunow points out. There is, therefore, no doubt of this variety of *N. marginulata* being the same species as *N. plana;* and, as already suggested, it might be well to add the other varieties also. H. L. Smith's type no. 363 is misnamed. It is a small variety of *N. dubia* W. Smith as figured by that author and as shown in H. L. Smith's type no. 341.

Found at station 2823, Gulf of California.

Nitzschia punctata (W. Smith) Grun. in Cleve & Grun. Sv. Vet. Akad. Handl. **17^2:** 68. 1880. Van Heur. Synop. 171. *pl. 57. f. 2–3.* 1881; Treat Diat. 384. *f. 125, pl. 15. f. 491–492.* 1896. De Toni, Syll. Alg. **2:** 496 1892 (not Bail.).

Tryblionella punctata W. Smith, Synop. Brit. Diat. **1:** 36. *pl. 10. f. 76a′* (not *f. 76a*), *pl. 30. f. 261.* 1853. Rabh. Fl. Eur. Alg. **1:** 148. 1864.

The specimens found by me have markings nearly as coarse as those of *N. granulata* Grun.;[a] they, however, have the decided marginal loculi on the dorsal side of the valve and are clearly in all respects coarsely marked examples of *N. punctata.* The diatom given this name by L. W. Bailey[b] is *N. brightwellii* Kitton and has no relation with the above.

Found at station 3698, off Honshu Island, Japan.

Nitzschia scabra Cleve in Nordensk. Vega Exped. **3:** 480. *pl 38. f. 73a–b.* 1883. De Toni, Syll. Alg. **2:** 532. 1892.

My specimen agrees with the above perfectly, except that the puncta are set wider apart. It has the peculiar "shagreen-like appearance" referred to by Cleve. It is 0.183 mm. long. I do not favor uniting this with *N. sigma* W. Smith, although Cleve brackets that name with a question mark.

Found at station 3696, off Honshu Island, Japan.

Nitzschia sigma (Kütz.) W. Smith, Synop. Brit. Diat. **1:** 39. *pl. 13. f. 108.* Pritch. Hist. Infus. ed. 4. 781. *pl. 4. f. 21.* 1861. Rabh. Fl. Eur. Alg. **1:** 156. 1864. Grun. Journ. Roy. Micr. Soc. **2:** 681, 1879. Brun, Diat. Alp. 105. *pl. 5. f. 24.* 1880. H. L. Smith, Sp. Diat. Typ. no. 367. 1874. Van Heur. Synop. *pl. 65. f. 7–8, pl. 66. f. 1–9.* 1881; Treat. Diat. 396. *pl. 16. f. 531–535.* 1896. Cleve in Nordensk. Vega Exped. **3:** 480, 506. 1883. Lewis, Proc. Acad. Phila. **1861:** 71. 1862. De Toni, Syll. Alg. **2:** 530. 1892.

Synedra ? sigma Kütz. Bacill. 67. *pl. 30. f. 14.* 1844 ?

Amphipleura rigida Kütz. Bacill. 104. *pl. 4. f. 30.* 1844 ?

Amphipleura sigmoidea W. Smith, Synop. Brit. Diat. **1:** 45. *pl. 15. f. 128.* 1851 (not *N. sigmoidea* (Nitzsch) W. Smith).

Nitzschia anguillula Schum. Schrift. Phys. Ökon. Ges. Konigsb. **5:** 53. *pl. 1. f. 12.* 1867;

N. sigma anguillula Grun. in Schneider, Beitr. Kennt. Kauk. 119. 1878.

Nitzschia sigmoidea H. L. Smith, Sp. Diat. Typ. no. 369. 1874.

Nitzschia habirshawii Feb.; H. L. Smith, Sp. Diat. Typ. no. 346. 1874.

N. sigma habirshawii Van Heur. Synop. *pl. 66. f. 4.* 1881.

Nitzschia (*sigma* var. ?) *valida* Cleve & Grun. Bih. Sv. Vet. Akad. Handl. **5^8:** 12. *pl. 3. f. 19.* 1878. Van Heur. Synop. *pl. 65. f. 4 5.* 1881. De Toni, Syll. Alg. **2:** 532. 1892.

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[a] Loc. cit.

[b] Bost. Journ. Nat. Hist. **7:** 344. *pl. 8. f. 76.* 1862.

Nitzschia (*sigma* var. ?) *major* Grun.; Van Heur. Synop. *pl. 65. f. 6.* 1881.
Nitzschia (*sigma* var. ?) *latiuscula* Grun.; Van Heur. Synop. *pl. 65. f. 3.* 1881.

I leave out of the above list *Navicula lamprocampa* Ehrenb.,[a] here included by De Toni,[b] and *Nitzschia clausii* Hantzsch[c] placed here by Grunow.[d] H. L. Smith, by changing *Amphipleura sigmoidea* W. Smith, to *Nitzschia sigmoidea* has confused it with the real *Nitzschia sigmoidea* W. Smith,[e] a diatom that can not be included here. Regarding *N. sigmatella* Greg.[f] I can see no reason for including it here, as is done by De Toni and others. There can be no doubt of the *N. sigma sigmatella* Grun.,[g] included above, which is a quite different diatom.

Found at station 3712H, about 100 miles off Oregon.

SPHINCTOCYSTIS Hass.

Sphinctocystis Hass. Hist. Brit. Alg. **1**: 436. *pl. 102. f. 3.* 1845.
Frustulia C. Ag. in part; Kütz. Linnaea **8**: 554. 1833.
Navicula Bory, in part; Ehrenb. Infus. 185. *pl. 13. f. 22.* 1838.
Denticula Kütz. in part; Bacill. 44. *pl. 3. f. 60.* 1844.
Surirella Turp. in part; Ehrenb. Mikrog. *pl. 15A. f. 50–51.* 1854.
Cymatopleura W. Smith, Ann. Mag. Nat. Hist. II. **7**: 12. *pl. 3. f. 8–9.* 1851; Synop. Brit. Diat. **1**: 36. *pl. 10. f. 78–81.* 1853. H. L. Smith, The Lens **1**: 85. 1872. Ralfs, Pritch. Hist. Infus. ed. 4. 793. 1861. Van Heur. Synop. 167. 1881; Treat. Diat. 366. *f. 119.* 1896. Brun, Diat. Alp. 96. 1880. De Toni, Syll. Alg. **2**: 598. 1892.

Although this genus shows close relation to Surirella Turp., and even closer to the forms of Nitzschia Hass., which were formerly included in Tryblionella W. Smith, its distinctness is generally conceded.[h]

The older name of Hassall is here restored. Smith, in rejecting this name, says: "I should have been glad to have adopted Mr. Hassall's genus 'Sphinctocystis,' but as this term refers merely to a peculiarity in the external form of one species, I am obliged to reject it." If the failure of a name to be accurately descriptive were valid cause for its rejection, Smith's substitution would also have to go.

Sphinctocystis librile (Ehrenb.) Hass. Hist. Brit. Alg. **1**: 436. *pl. 102. f. 3.* 1845.
Navicula librile Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1831**: 81. 1833; **1833**: 267. 1835; Ber. Akad. Wiss. Berl. **1836**: 53. 1837; Infus. 185. *pl. 13. f. 22.* 1858.
Frustulia quinquepunctata Kütz. Linnaea **8**: 554. *pl. 14. f. 28.* 1833.
Surirella solea Breb. in Breb. & God. Consid. 17. 1838. Kütz. Bacill. 60. *pl. 3. f. 61.* 1844. Rabh. Sussw. Diat. 28. *pl. 3. f. 7b–c.* 1853. Kütz. Sp. Alg. 34. 1844. Weisse, Mel. Biol. Acad. Sci. St. Petersb. **4**: 660. *pl. 1. f. 18.* 1865.
Surirella librile Ehrenb. Mikrog. *pl. 6. I. f. 19, pl. 14. f. 38.* 1854.
Cymatopleura solea W. Smith, Ann. Mag. Nat. Hist. II. **7**: 12. *pl. 3. f. 8–9.* 1851; Synop. Brit. Diat. **1**: 36. *pl. 10. f. 78.* 1853. Pritch. Hist. Infus. ed. 4. 793. *pl. 9. f. 155* (figure poor), *pl. 16. f. 9.* 1861. Rabh. Fl. Eur. Alg. **1**: 60. 1864. Grun. Verh. Zool.-Bot. Ges. Wien **12**: 466. 1862. H. L. Smith, Sp. Diat. Typ. no. 114. 1874. Brun, Diat. Alp. 97. *pl. 1. f. 10.* 1880. Cleve & Möll. type no. 226–227. Van Heur. Synop. *pl. 55. f. 5–7.* 1881; Treat. Diat. 367. *pl. 12. f. 482b.* 1896.

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[a] Kütz. Bacill. 102. *pl. 4. f. 5.* 1844.
[b] De Toni, Syll. Alg. **2**: 530. 1892.
[c] Hedwigia **2**: 40. 1860.
[d] Journ. Roy. Micr. Soc. **2**: 22. 1879.
[e] W. Smith, Synop. Brit. Diat. **1**: 38. *pl. 13. f. 104.* 1853.
[f] Quart. Journ. Micr. Sci. **3**: 38. *pl. 4. f. 2.* 1855.
[g] Van Heur. Synop. *pl. 66. f. 6.* 1881.
[h] See remarks under Cymatopleura by W. Smith, and by Ralfs in the above citations.

De Toni, Syll. Alg. **2**: 599. 1892. Griff. & Henf. Micr. Dict. ed. 4. 227. *pl. 16. f. 23.* 1883. Wolle Diat. N. A. *pl. 60. f. 1–4, 13.* 1890.

Cymatopleura apiculata W. Smith, Synop. Brit. Diat. **1**: 37. *pl. 10. f. 79.* 1853. Wolle, Diat. N. A. *pl. 60. f. 9, 12.* 1890. Belloc, Rev. de Comm. **3**: 52. *pl. 1. f. 20.* 1887.

Hassall's writing of the species name as *S. librilis* is erroneous. He evidently assumed that Ehrenberg had used the wrong gender of the Latin adjective in his *Navicula librile*, and as Sphinctocystis is feminine, he wrote *S. librilis*. But Ehrenberg used the noun *librile*, meaning a scale-beam, because of the long, notched appearance of this species when seen from the zonal side. Kützing's *F. quinquepunctata* is a practically indefinable form as figured and described by him, but as he refers to it under *Surirella solea* as the same thing, I include it in the synonymy.

Found at station 2885, off Oregon.

Sphinctocystis undulata (Ehrenb.) Mann.

Navicula ? undulata Ehrenb. Infus. 187. *pl. 21. f. 16.* 1838.

Surirella oophaena Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841**: 136. *pl. 3. V. f. 1.* 1843.

Denticula undulata Kütz. Bacill. 44. *pl. 3. f. 60.* 1844.

Surirella elliptica Breb.; Kütz. Bacill. 61. *pl. 28. f. 28.* 1844.

Surirella undulata Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1847**: 442. 1849; Mikrog. *pl. 14. f. 39, pl. 33. II. f. 111, pl. 35A. VII. f. 25–26, pl. 37. I. f. 25.* 1854.

Surirella ovum Naeg.; Kütz. Sp. Alg. 889. 1849.

Cymatopleura hibernica W. Smith, Ann. Mag. Nat. Hist. II. **7**: 13. *pl. 3. f. 12.* 1851; Synop. Brit. Diat. **1**: 37. *pl. 10. f. 81.* 1851. Van Heur. Synop. *pl. 55. f. 3–4.* 1881. H. L. Smith, Sp. Diat. Typ. no. 113. 1874. Rabh. Fl. Eur. Alg. **1**: 61. 1864. De Toni, Syll. Alg. **2**: 600. 1892.

Cymatopleura elliptica W. Smith, Ann. Mag. Nat. Hist. II. **7**: 13. *pl. 3. f. 10–11.* 1851; Synop. Brit. Diat. **1**: 37. *pl. 10. f. 80a–c.* 1853. Rabh. Fl. Eur. Alg. **1**: 89. 1864. Van Heur. Synop. 168. *pl. 53. f. 1–4.* 1881; Treat. Diat. 367. *pl. 12. f. 480b–481b, pl. 31. f. 863.* 1896. Pritch. Hist. Infus. ed. 4. 793. *pl. 9. f. 149, pl. 16. f. 7–8.* 1861. Brun, Diat. Alp. 96. *pl. 1. f. 8, pl. 9. f. 15.* 1880. Grun. Verh. Zool. Bot. Ges. Wien **12**: 463. *pl. 11. f. 13.* 1862. H. L. Smith, Sp. Diat. Typ. no. 112. 1874. De Toni, Syll. Alg. **2**: 598. 1892. Griff. & Henf. Micr. Dict. ed. 4. 227. *pl. 16. f. 24* 1883. Wolle, Diat. N. A. *pl. 60. f. 5–7.* 1890. Cleve & Moll. type no. 2, 4, 11–12.

Surirella undata Ehrenb. Mikrog. *pl. 33A. I. f. 20, 21, 21*.* 1854.

Surirella plicata Ehrenb. Mikrog. *pl. 15A. f. 50. f. 51a–b.* 1854. Weisse, Mel. Biol. Acad. Sci. St. Petersb. **5**: 107. *pl. 1. f. 10.* 1865.

Cymatopleura nobilis Hantzsch, Hedwigia **2**: 36. *pl. 6. f. 6.* 1860.

Cymatopleura hibernica rhombica Chase; De Toni, Syll. Alg. **2**: 601. 1892.

This long list of synonyms might be increased by *Cymatopleura angulata* Grev.[a] It stands midway between this and the former species *S. librile*, the form variety of the latter called *C. apiculata* being very close to it.

Found at station 4505H, near Santa Cruz light-house, Monterey Bay, Cal.

SURIRELLA Turp.

Surirella Turp. Mem. Mus. Paris **16**: 361. *pl. 15. f. 1–7, 9–10, 14.* 1828 (exclusive of the other figures). Rabh. Fl. Eur. Alg. **1**: 9, 51. *f. 12.* 1864. Pritch. Hist. Infus. ed. 4. 794. 1861. W. Smith, Synop. Brit. Diat. **1**: 30. *pl. 8–9.* 1853. Van Heur. Synop. 186. *pl. 71–74.* 1881; Treat. Diat. 368. *f. 120. pl. 12–13.* 1896. Brun, Diat. Alp. 97. 1880. Castr. Rep. Voy. Chall. Bot. **2**: 59. *pl. 10.* 1886.

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[a] Trans. Micr. Soc. Lond. n. s. **10**: 89, *pl. 9. f. 1.* 1862.

Suriraya Turp. Hanst. Bot. Abhand. **2:** 107. 1871. De Toni, Syll. Alg. **2:** 567. 1892.

Novilla Heib. Krit. Overs. Danske Diat. 24. 1863. Cleve, Bih. Sv. Vet. Akad. Handl. **1^{11}:** 11. 1873.

Stenopterobia Breb.; Grun. in Cleve, Ofv. Kgl. Vet. Akad. **38^{10}:** 7. 1882. Möll. type nos. 2, 5, 15, as subgenus.

Plagiodiscus Grun. Mo. Micr. Journ. **18:** 172. *pl. 194. f. 8–9a–b.* 1877 (cf. Schmidt, Atlas *pl. 56. f. 1.* 1877).

Navicula Bory, in part Ehrenb. Infus. 186. *pl. 14. f. 1–2. pl. 21. f. 15.* 1838.

Nitzschia Hass. in part; Kütz. Bacill. 60. *pl. 3. f. 46.* 1844.

Cocconeis Ehrenb. in part; Grun. Verh. Zool. Bot. Ges. Wien **12:** 456. *pl. 9. f. 10.* 1862.

William Smith in discussing the relations of this genus, considers it to be close to those robust forms of Nitzschia which he calls Tryblionella; its nearer affinity is, however, Campylodiscus Ehrenb., from which it differs simply in the circular outline and uniform saddle shape of the latter. These differences are so constant that an unnecessary loss to classification would result from uniting the two genera. The nearest approach to an intermediate form is to be found in *Surirella spiralis* Kütz. (*Campylodiscus spiralis* (Kütz.) W. Smith [a]). The genus has a more remote resemblance to Sphinctocystis Hass. (*Cymatopleura* W. Smith), but except in a few forms no confusion can arise between the two.

The separation of the greatly elongated forms into the genus Stenopterobia of the kidney-shaped sports into the genus Plagiodiscus and of the forms showing a wedge-shaped appearance from the zonal side into the genus Novilla are utterly useless distinctions. The attempt of Pfitzer and De Toni to change the name into Suriraya so as to make it fit better the name of the French physician, Doctor Suriray, in whose honor Turpin formed the name, is inexcusable, as Turpin had a right to call his genus whatever name he wished.

Surirella bifrons Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1841:** 388. *pl. 3. V. f. 5, pl. 4. III. f. 1.* 1843; Mikrog. *pl. 14. f. 36, pl. 15, A. f. 46. B. f. 17* (*pl. 7. I. f. 2* and *pl. 7. III. A. f. 17–20* are indeterminate). 1854. Schmidt, Atlas *pl. 22. f. 5. 10–12, pl. 22. f. 6* (unnamed), *pl. 23. f. 1–2.* 1875; *pl. 245. f. 8–10.* 1904. Griff. & Henf. Micr. Dict. ed. 4. 746. *pl. 17. f. 22.* 1883. Kütz. Bacill. 61. *pl. 7. f. 10, pl. 28. f. 29.* 1844. Rabh. Süssw. Diat. 29. *pl. 3. f. 21.* 1853.

Navicula bifrons Ehrenb. Phys. Abh. Akad. Wiss. Berl. **1832:** 259. 1834. Ber. Akad. Wiss. Berl. **1836:** 53. 1837; Infus. 186. *pl. 14. f. 2.* 1838.

Surirella biseriata Breb. Consid. Diat. 53. *pl. 7.* 1838. Hass. Hist. Brit. Algae 438. *pl. 102. f. 1.* 1845. W. Smith, Ann. Mag. Nat. Hist. II. **7:** 8. *pl. 2. f. 1.* 1851; Synop. Brit. Diat. **1:** 30. *pl. 8. f. 57.* 1853. Grun. Verh. Zool. Bot. Ges. Wien **12:** 454. *pl. 10. f. 7.* 1862. Rabh. Fl. Eur. Alg. **1:** 9, 53. *f. 12b–c.* 1864. Pritch. Hist. Infus. ed. 4. 794. *pl. 16. f. 20–26.* 1861. Schmidt, Atlas *pl. 22. f. 13–14.* 1875. H. L. Smith, Sp. Diat. Typ. no. 514. 1874. Brun, Diat. Alp. 99. *pl. 2. f. 3* (not *f. 9*), *pl. 9. f. 17.* 1880. Belloc, Rev. de Comm. **3:** 52. *pl. 3. f. 21.* 1887. Van Heur. Synop. 186. *pl. 72. f. 1–3.* 1881; Treat. Diat. 368–369. *f. 120, pl. 12. f. 575.* 1896.

Suriraya biseriata Breb.; De Toni, Syll. Alg. **2:** 567. 1892.

Kützing, Griffith and Henfrey, and Rabenhorst have rightly united *S. bifrons* and *S. biseriata* under the former name. Most authors give preference to Brebisson's name, though nearly all except Schmidt in his Atlas recognize that the two are synonymous. Ehrenberg's name, accompanied by a clear diagnosis, is prior to that of Brebisson. It is found in the volume of the Abhandlungen for 1833, which is dated 1835; but on the fascicle in which it occurs is printed, "Gelesen in der Akademie der Wissenschaft am 2 Juli 1832, revidirt und mit einigen Zusätzen gedruckt im Mai 1834."

Found at station 3607, Bering Sea.

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[a] W. Smith, Synop. Brit. Diat. **1:** 29. *pl. 7. f. 54.*

Surirella fastuosa Ehrenb. Ber. Akad. Wiss. Berl. **1840**: 214. 1841; Phys. Abh. Akad. Wiss. Berl. **1841**: 388. *pl. 2. IV. f. 7. VI. f. 14, pl. 3. VII. f. 11–12.* 1843. Kütz. Bacill. 62. *pl. 28. f. 19a–d.* 1844. W. Smith, Ann. Mag. Nat. Hist. II. **7**: 10. *pl. 3. f. 3.* 1851; Synop. Brit. Diat. **1**: 32. *pl. 9. f. 66.* 1853. Greg. Quart. Journ. Micr. Sci. **3**: 40. *pl. 4. f. 12.* 1855. Moeb. Diat.-taf. *pl. 5. f. 12, pl. 43. f. 1.* 1890. Pritch. Hist. Infus. ed. 4. 797. 1861. Rabh. Fl. Eur. Alg. **1**: 58. 1864. Jan. & Rabh. in Rabh. Beitr. **1**: 13. *pl. 1. f. 15.* 1863. Jan. Abh. Schles. Ges. Vaterl. Cult. **1862**^{2}: 14. *pl. 1A. f. 37.* 1862. Grun. Verh. Zool. Bot. Ges. Wien **12**: 461. *pl. 9. f. 11* (*f. 12* doubtful). 1862. Grev. Trans. Micr. Soc. Lond. n. s. **10**: 18. *pl. 3. f. 1.* 1862. Van Heur. Synop. 188. *pl. 73. f. 18.* 1881; Treat. Diat. 372. *pl. 13. f. 583–584.* 1896. Pant. Beitr. Bacill. Ung. **2**: 71. 1889; **3**: *pl. 31. f. 450.* 1893. Schmidt, Atlas *pl. 4. f. 1 2, 8, pl. 5. f. 4, 7–15, pl. 19. f. 1, 8, 12, 13, pl. 20. f. 1.* 1875; *pl. 56. f. 7.* 1877; *pl. 206. f. 1–11, 21.* 1897. Truan, Anal. Soc. Espan. Hist. Nat. **14**: 76. *pl. 5. f. 11–12.* 1885. Wolle, Diat. N. A. *pl. 55. f. 5* (not *pl. 52. f. 10*). 1890.

Surirella lata W. Smith, Synop. Brit. Diat. **1**: 31. *pl. 9. f. 61.* 1853. Van Heur. Synop. 188. *pl. 72. f. 17.* 1881. Rabh. Fl. Eur. Alg. **1**: 59. 1864. Schmidt, Atlas *pl. 5. f. 1.* 1874; Jahresb. Komm. Deut. Meere **2**: *pl. 3. f. 9* (3 fig.). 1874.

Surirella hohenackerii Rabh. Hedwigia **1**: 103. *pl. 13. f. 2.* 1859.

Surirella cuneata Schmidt, Atlas *pl. 4. f. 1–2.* 1875.

Suriraya fastuosa Ehrenb.; De Toni, Syll. Alg. **2**: 582. 1892.

This diatom is one of the commonest of the genus; at the same time it is very variable. In consequence of both facts it runs gradually into a number of other species, so that the list of synonyms given above could be easily increased. I have confined myself to evident cases of identity, as the specific lines here are most difficult to fix with exactness.[a]

Found at stations 2807, 2808, 2823, 2923, 2929, 2635H, 3688H, Galapagos Islands to central California and Okhotsk Sea.

Surirella formosa Cleve, Bih. Sv. Vet. Akad. Handl. **18**^{5}: 17. *pl. 4. f. 49.* 1881. Schmidt, Atlas *pl. 205. f. 8.* 1897.

Suriraya formosa Cleve; De Toni, Syll. Alg. **2**: 584. 1892.

My specimens, which are exceedingly abundant in the one dredging mentioned, differ from Cleve's figure and description in some important particulars. The markings are much more elaborate than he indicates, which may have been due to inadequate material, as he says his form is "very rare." The border of my specimens is much narrower and more strongly ribbed and is without the beads. The branching of the forked tips on the inner side of the row of processes with swollen ends is more pronounced. There are other minor differences but not sufficient to indicate a new species. The great points of resemblance are the swollen processes and the ring of beads in the otherwise hyaline central area.

Found at station 2807, Galapagos Islands.

Surirella patens Schmidt, Atlas *pl. 4. f. 16–17.* 1875; *pl. 56. f. 10–11.* 1877. Jan. Diat. Gaz. Exped. *pl. 21. f. 28–29.*

Suriraya patens Schmidt; De Toni, Syll. Alg. **2**: 597. 1892.

This diatom is of the *S. fastuosa* type, but hardly near enough to be united. To the above references might be added the unnamed figures of Schmidt and Janisch.[b]

Found at station 2807, Galapagos Islands.

Surirella robusta Ehrenb. Ber. Akad. Wiss. Berl. **1840**: 215. 1841; Mikrog. *pl. 15A. f. 43; pl. 17, I. f. 14; II. f. 1a–b* (*pl. 11. f. 31* and *pl. 16. III. f. 31* indeterminate). 1854. Kütz. Bacill. 61. 1844. Pritch. Hist. Infus. ed. 3. 795. 1861. Schmidt,

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[a] Cf. Schmidt, Atlas *pl. 4–5.* 1875, for illustration of this difficulty.

[b] Schmidt, Atlas *pl. 56. f. 12.* 1876. Jan. Diat. Gaz. Exped. *pl. 21. f. 30.*

Atlas *pl. 22. f. 3–4.* 1875. Van Heur. Synop. 187. *pl. 71. f. 1, 2* (exclusive of variety). 1881; Treat. Diat. 371. *pl. 12. f. 577* (exclusive of variety). 1896.

Suriraya robusta Ehrenb.; De Toni, Syll. Alg. **2**: 571. 1892.

Surirella nobilis W. Smith. Synop. Brit. Diat. **1**: 32. *pl. 8. f. 63.* 1853. Rabh. Fl. Eur. Alg. **1**: 55. 1864. Pritch. Hist. Infus. ed. 4. 795. 1861. Grun. Verh. Zool. Bot. Ges. Wien **12**: 456. 1862.

Surirella splendida W. Smith, in Ann. Mag. Nat. Hist. II. **7**: 9. *pl. 2. f. 3.* 1851 (not *f. 2;* not Synop. Brit. Diat. **1**: 32. *pl. 8. f. 62.* 1853; not Ehrenb.; not Kütz.).

Surirella valida Schmidt, Atlas *pl. 23. f. 3.* 1875.

Van Heurck unites *S. splendida* Ehrenb. with the above, and also *S. tenera* Greg. Both of these I consider distinct, as do De Toni and others. Schmidt gives his name *valida*, though expressing doubt of its not being a variety of *S. robusta*. Despite his very assertive specific name, I think the doubt is well founded. It is the variety most common in the following dredging.

Found at station 2871, off Washington.

CAMPYLODISCUS Ehrenb.

Campylodiscus Ehrenb. Ber. Akad. Wiss. Berl. **1840**: 207. 1841. Rahb. Fl. Eur. Alg. **1**: 45. 1864. Pritch. Hist. Infus. ed. 4. 798. 1861. Grun. Verh. Zool. Bot. Ges. Wien **12**: 431. 1862. Van Heur. Synop. 1^{16}: 189. 1881. Castr. Rep. Voy. Chall. Bot. **2**: 62. 1886. De Toni, Syll. Alg. **2**: 603. 1892. Eng. & Pr. Pflanzenfam. 1^{1b}: 146. *f. 267.* 1896.

Coronia Ehrenb. Ber. Akad. Wiss. Berl. **1840**: 206. 1841, as subgenus.

Calodiscus Rabh. Süssw. Diat. 12. *pl. 3.* 1853. Pritch. Hist. Infus. ed. 4. 802. *pl. 8. f. 50.* 1861.

Surirella Turp. in part; Brun, Diat. Alp. 101. *pl. 1. f. 16–17.* 1880.

Campylodiscus concinnus Grev. Trans. Micr. Soc. Lond. n. s. **8**: 30. *pl. 1. f. 2.* 1860. Schmidt, Atlas *pl. 18. f. 16–17.* 1875; *pl. 53. f. 9.* 1877. Pritch. Hist. Infus. ed. 4. 800. 1861.

Campylodiscus marginatus Johnst. Quart. Journ. Micr. Sci. **8**: 13. *pl. 1. f. 11.* 1860. Grev. Trans. Micr. Soc. Lond. n. s. **8**: 30. *pl. 1. f. 2.* 1860. Moeb. Diat.-taf. *pl. 30. f. 2.* 1890 (not Ehrenb. 1845).

Campylodiscus imperialis Grev. Trans. Micr. Soc. Lond. n. s. **8**: 30. *pl. 1. f. 3.* 1860 (?).

Campylodiscus lineatus Grun.; Schmidt, Atlas *pl. 18. f. 18.* 1875.

Campylodiscus samoensis Grun.; Schmidt, Atlas *pl. 15. f. 18–20.* 1875.

Campylodiscus crebrecostatus Grev. err. det. Eulen.; Schmidt, Atlas *pl. 15. f. 16–17.* 1875.

My specimen agrees perfectly with the figures by Schmidt, named by Eulenstein "*C. crebrecostatus* Grev." This identification is false, as can be seen by comparing with Greville's original figure and description.[a] Greville recognizes the probability of this species being identical with Johnston's *C. marginatus*, and he so names it in his illustration. The identity is a fact, but Johnston's name is inadmissible, having been preempted by Ehrenberg[b] for a quite different species. I am not satisfied with making the above species synonymous with *C. imperialis* Grev., as is done by De Toni.[c] Greville's figure and description show marked differences, especially in the border. But whether synonymous or not, De Toni's selection of the name *imperialis* is wrong, as both the above name and that of Johnston hold priority. De Toni also includes *C. radiatus* Leud.-Fort.,[a] a diatom that does not in the least resemble this species.

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[a] Trans. Micr. Soc. Lond. n. s. **11**: 14. *pl. 1. f. 6.* 1863; also Moeb. Diat.-taf. *pl. 49. f.* 6. 1890.

[b] Ber. Akad. Wiss. Berl. **1845**: 362. 1846.

[c] De Toni, Syll. Alg. **2**: 609. 1892.

Found at station 2923, off southern California.

Campylodiscus ecclesianus Grev. Quart. Journ. Micr. Sci. **5:** 10. *pl. 3. f. 5.* 1857. Pritch. Hist. Infus. ed. 4. 801. 1861. Schmidt, Atlas *pl. 16. f. 8-11*, *pl. 17. f. 16.* 1875; *pl. 208. f. 3.* 1897; also *pl. 16. f. 3, 5* (unnamed). 1875. Moeb. Diat.-taf. *pl. 11. f. 5.* 1890. Pant. Beitr. Bacill. Ung. **1:** 40. *pl. 3. f. 26.* 1886; **2:** 71. 1889. De Toni, Syll. Alg. **2:** 623. 1894.

Campylodiscus fenestratus Grev. Quart. Journ. Micr. Sci. **5:** 9. *pl. 3. f. 4.* 1857. ? Moeb. Diat.-taf. *pl. 11. f. 4.* 1890. Grun. Verh. Zool. Bot. Ges. Wien **12:** 433. 1862. Pritch. Hist. Infus. ed. 4. 801. 1861.

Campylodiscus rabenhorstii Jan. in Rabh. Beitr. **1:** 6. *pl. 1. f. 6-7.* 1863. Schmidt, Atlas *pl. 53. f. 12-14.* 1877. Grun. Verh. Zool. Bot. Ges. Wien **12:** 435. 1862.

Campylodiscus weissflogi Deby; Fricke, Verzeich. 23. 1902.

Campylodiscus taenoides Deby; Fricke, Verzeich. 23. 1902.

Although specimens of this species do show something like the "four-square windows" mentioned by Greville in his description of *C. fenestratus*,[b] it is difficult to believe that Greville was misled by an illusion of two superposed valves and gave a name to that illusion when he had both forms before him; especially as he describes the border of *C. fenestratus* so differently from that of *C. ecclesianus*, and that, too, in a way that could not result from two superposed valves. For in *C. fenestratus* it is of narrow continuous costae, while *C. ecclesianus* has a strong double row. However ingenious this deduction of Greville's mistake is, I am not at all certain it is correct. I have, therefore, left the name as above, whereas if the two be actually synonymous the first-mentioned name, *C. fenestratus*, should be used.

The form found by me has the lines of the central area so very faint that they are practically invisible; a variation somewhat like that shown in another figure by Schmidt.[c]

Found at station 4516H, Gulf of California.

Campylodiscus galapagensis, Mann, sp. nov. PLATE LI, FIGURE 3.

Frustule comparatively flat, the double bend of the valves, characteristic of the genus, being considerably below the average; rim divided into compartments by very thin cross septa formed by continuations of the sides of the costae, the costae making a double ring within the rim; the compartments of the rim thus being of the same width as, and continuous with, the costae; each compartment ornamented with a stout process projecting inward from the outer margin or edge; within the rim or border two rows of costae; outer row consisting of smooth, large costae, three times as long as broad, their outer ends being slightly notched, their inner ends rounded; costae of the second row continuous (not alternate) with those of the outer row and of about the same length, partly cleft, however, or in some cases wholly divided longitudinally by a thin median line, so that they appear to be double the number and half the width of the costae of the outer row; central area large and marked, first, by a few shadowy indistinct radiating lines, and, second, by a single row on each side of large oval beads, irregularly placed, but generally parallel to the margin.

Diameter of valve, 0.19 mm.; width of costae at margin, 28 in 0.1 mm.

Type in the U. S. National Museum, No. 590155, from station 2807, Galapagos Islands, April 4, 1888; 812 fathoms, bottom of Globigerina ooze and coral mud.

There is enough similarity between this and *C. peramplus* Cleve,[d] to note here the possibility of the two being the same; especially as Cleve's form was also found at the Galapagos Islands. If this be the case, my name must give way to Cleve's. But if his poor figure and meager description are to be trusted, the double row of costae are not present and the ornamentation of the border is totally different. Cleve remarks that his form is perhaps a variety of *C. ecclesianus* Grev., and refers to the double row of alternating costae in the latter. It will be seen that the costae in my form are not *alternating* and are of very different construction. They are also relatively much stouter than Cleve's, there being 28 in 0.1 mm. on a valve with a diameter of 0.19 mm., whereas Cleve's has 40 to 50 costae in 0.1 mm. on a valve with a diameter of 0.12 to 0.16 mm. At any rate, this form needs to be accurately defined: and I therefore figure and name it, subject to the foregoing remarks.

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[a] Mem. Soc. Emul. St. Brieuc 48. *pl. 5. f. 57.* 1879.

[b] Cf. also Schmidt, Atlas *pl. 16. f. 8.* 1875.

[c] Op. cit. *pl. 17. f. 16.*

[d] Sv. Vet. Akad. Handl. **18**^{5}: 17. *pl. 4. f. 53.* 1881.

Campylodiscus horologium Williamson, Ann. Mag. Nat. Hist. II. **1**: 321. 1848. W. Smith Synop. Brit. Diat. **1**: 28. *pl. 6. f. 51.* 1853. Pritch. Hist. Infus. ed. 4. 799. 1861. Grun. Verh. Zool. Bot. Ges. Wien **12**: 437. 1862. Schmidt, Atlas *pl. 17. f. 17.* 1875; *pl. 51. f. 7.* 1877; *pl. 207. f. 23–25.* 1897. De Toni, Syll. Alg. **2**: 616. 1892.

Campylodiscus mediterraneus Grun.; Cleve & Möll. type no. 154. 1878. Cf. also Schmidt, Atlas *pl. 17. f. 7.* 1875.

Campylodiscus pfitzeri Schmidt, Atlas *pl. 17. f. 5–6.* 1877.

Campylodiscus lepidus Castr. Rep. Voy. Chall. Bot. **2**: 63. *pl. 11. f. 7.* 1886.

Campylodiscus orbicularis Castr. Rep. Voy. Chall. Bot. **2**: 64. *pl. 16. f. 10.* 1886.

Schmidt's *C. pfitzeri* is a slightly more robust, but unimportant variety of the above. Found at station 3696, off Honshu Island, Japan.

Campylodiscus kinkeri Schmidt, Atlas *pl. 207. f. 16.* 1897.

This species is closely related to *C. triumphans* Schmidt,[a] and *C. brightwellii* Grun.;[b] but these two, together with several other named forms, are certainly varieties of *C. undulatus* Grev.[c] In the case, however, of *C. kinkeri* there is a massiveness in the large double row of costae and a distinctness in the border which lead me tentatively to classify my specimen as above, the agreement with Schmidt's figure being exact.

Found at station 2920H, Hawaiian Islands.

A similar form from station 3696 corresponds exactly to *C. erosus* Castr.,[d] but both that and my form are inner or eroded valves of some of the foregoing.

Campylodiscus latus Shadb. Trans. Micr. Soc. Lond. n. s. **2**: 16. *pl. 1. f. 13.* 1854. Moeb. Diat.-taf. *pl. 3. f. 13.* 1890. Grun. Verh. Zool. Bot. Ges. Wien **12**: 436. 1862. Schmidt, Atlas *pl. 18. f. 21–22.* 1875; *pl. 207. f. 6–11.* 1897. De Toni, Syll. Alg. **2**: 617. 1892.

Campylodiscus ambiguus Grev. Trans. Micr. Soc. Lond. n. s. **8**: 31. *pl. 1. f. 5.* 1860. Moeb. Diat.-taf. *pl. 30. f. 5.* 1890. Schmidt, Atlas *pl. 18. f. 23–26.* 1875; *pl. 51. f. 14.* 1897. Pritch. Hist. Infus. ed. 4. 801. 1861.

Campylodiscus contiguus Schmidt, Atlas *pl. 18. f. 19–20.* 1875.

Campylodiscus aemulus Schmidt, Atlas *pl. 207. f. 12.* 1897.

The specific identity of the above four forms is unquestionable. I do not, however, see the necessity of adding to this list *C. centralis* Greg.[e] or the long and dissimilar list by Leudŭger-Fortmorel[f] which De Toni[g] looks upon as also synonymous. It may be that an examination of the diatoms themselves would show such identity in some of these forms, for Leuduger-Fortmorel's drawings in this work are not very accurate; but the drawings, judged in the light of the descriptions, are certainly not all of one species, and, so faras it is possible to make out, none of them belong here.

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[a] Schmidt, Atlas *pl. 15. f. 4, 5.* 1877.

[b] Schmidt, Atlas *pl. 15. f. 6, 7.* 1877.

[c] Quart. Journ. Micr. Sci. **11**: 229. *pl. 9. f. 4.* 1863.

[d] Castr. Rep. Voy. Chall. Bot. **2**: *pl. 11. f. 5.* 1886.

[e] Trans. Roy. Soc. Edinb. **21**: 501. *pl. 11. f. 51.* 1857.

[f] Mem. Soc. Emul. St. Brieuc 44–46. 1879.

[g] Syll. Alg. **2**: 617. 1892.

Found at station 2920H, Hawaiian Islands.

Campylodiscus noricus Ehrenb. Ber. Akad. Wiss. Berl. **1840:** 205. 1841; **1845:** 154. 1846. Rabh. Hedwigia **1:** 52. *pl. 9. f. 2.* 1854. Kütz. Bacill. 59. 1844. ed. 3. 799. 1861. Grun. Verh. Zool. Bot. Ges. Wien **12:** 438. *pl. 10. f. 4, 5.* 1862. Schmidt, Atlas *pl. 55. f. 8.* 1877. H. L. Smith, Sp. Diat. Typ. no. 64. 1874. Van Heur. Synop. *pl. 77. f. 4–6.* 1881. Strose, Bacillarienlager 13. *pl. 1. f. 30.* 1884. Pant. Beitr. Bacill. Ung. **3:** *pl. 14. f. 215.* 1893. De Toni, Syll. Alg. **2:** 627. 1892.

Campylodiscus hibernicus Ehrenb. Ber. Akad. Wiss. Berl. **1845:** 154. 1846; Mikrog. *pl. 15A. f. 9.* 1854. Pritch. Hist. Infus. ed. 4. 799. *pl. 4. f. 38.* 1861. Schmidt, Atlas *pl. 55. f. 9–16.* 1877. Van. Heur. Synop. 190. *pl. 77. f. 3.* 1881. Grun. Verh. Zool. Bot. Ges. Wien **12:** 439. 1862.

Campylodiscus costatus W. Smith, Ann. Mag. Nat. Hist. II. **7:** 6. *pl. 1. f. 1.* 1851; Synop. Brit. Diat. **1:** 29. *pl. 6. f. 52.* 1853. Griff. & Henf. Micr. Dict. ed. 3. *pl. 12. f. 16.* 1875. Grun. Verh. Zool. Bot. Ges. Wien **12:** 439. *pl. 10. f. 6.* 1862. Hedwigia **2:** 29. *pl. 5. f. 1–2.* 1860.

Surirella norica Kütz.; Brun. Diat. Alp. 101. *pl. 1. f. 16–17; pl. 9. f. 30.* 1880.

Grunow[a] claims that *C. noricus* Ehrenb. can be provisionally held separate from *C. hibernicus* Ehrenb. because of its more numerous and more delicate ribs. This is hardly to be conceded. On the same basis the specimens I have found could be constituted a separate species. They correspond closely to Pantocsek's figure[b] in having the costae delicately striated with soft, wavy lines, broad at the margin and narrowing to a thread at the center; and especially in all reaching the center, so that the central hyaline space, like an obscure square, is obliterated.

Found at station 3635H, Bering Sea.

Campylodiscus taeniatus Schmidt, Atlas *pl. 16. f. 2.* 1875; *pl. 51. f. 1.* 1877. De Toni, Syll. Alg. **2:** 623. 1892.

Two varieties, even more contrasted than those figured by Schmidt, were found by me; the first without a prominent row of beads bordering the inner line of the first ring of costae, from station 3698, and the second with such a row, two beads to each costa, from station 2920H.

Found at stations 3698 and 2920H, off Honshu Island, Japan, and Hawaiian Islands.

XANTHIOPYXIS Ehrenb.

Xanthiopyxis Ehrenb. Ber. Akad. Wiss. Berl. **1844:** 273. 1845; Mikrog. *pl. 33. XVII. f. 17.* 1854.

As was stated under Chaetoceros, this genus is invalid, being made up principally, if not wholly, of internal cases from the frustules of Chaetoceros. It is placed here merely to enable the reader to trace the following widely figured form, as it occurs abundantly in the hydrographic soundings mentioned.

Xanthiopyxis oblonga Ehrenb. Mikrog. *pl. 33. XVII. f. 17.* 1854. Cleve, Journ. Quek. Micr. Club II. **2:** 175. *pl. 13. f. 18.* 1885.

Lithostylidium hirtum Ehrenb. Mikrog. *pl. 34. VII. f. 15.* 1854.

Xanthiopyxis panduriformis Pant. Beitr. Bacill. Ung. **1:** 43. *pl. 29. f. 7.* 1886.

Found at station 4029H, Bering Sea.

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[a] Schmidt, Atlas *pl. 55. f. 9–16.* 1877.

[b] Pant. Beitr. Bacill. Ung. **3:** *pl. 14. f. 215.* 1893.

DATA OF THE STATIONS AT WHICH DIATOMS WERE COLLECTED BY THE ALBATROSS.

HYDROGRAPHIC STATIONS.

All stations marked "H" are hydrographic soundings; all others are regular dredging and trawling stations. For complete list of stations to 1900 with data see Report of the U. S. Comm. Fish. **1900**: 387-562. 1901.

Use is made of the following abbreviations of terms expressing characters of bottoms, with a few names of instruments:

bk	black.	gn	green.	sp	specks.
br	brown.	gy	gray.	vol	volcanic.
brk	broken.	lav	lava.	wh	white.
bu	blue.	lt	light.	yl	yellow.
c	clay.	m	mud.	L. B. T	large beam trawl.
co	coral.	oz	ooze.	S. B. T	small beam trawl.
crs	coarse.	p	pebbles.	8′ Tnr	8-foot Tanner beam trawl.
dk	dark.	part	particles.	R. D	rake dredge.
fne	fine.	r	rock.		
g	gravel.	s	sand.		
glob	globigerina.	sh	shells.		

Station.	Date.	Locality. Lat. N.	Locality. Long. W.	Surface temperature.	Bottom temperature.	Depth.	Kind of bottom.	Remarks.
		° ′ ″	° ′ ″	° F.	° F.	Fms.		
2287H	1895. May 23	54 23 45	166 38 30	43	38.2	320	gn. m	Bering Sea.
2604H	1890. Sept. 25	39 12 10	123 50 50	54	49.4	60	gn. m	Off west coast United States.
2680H	1891. Oct. 11	36 44 40	122 09 30	55	37.0	864	br. m. s	Cable survey, California to Hawaiian Islands and return.
2685H	....do....	36 39 30	122 41 00	55	35.1	1,424	br. m	Do.
2686H	....do....	36 37 00	122 54 00	55	35.0	1,597	br. m	Do.
2687H	Oct. 12	36 35 00	123 06 00	55	35.0	1,661	br. m	Do.
2688H	....do...	36 32 30	123 19 00	54	35.0	1,907	br. m. s	Do.
2690H	....do...	36 28 00	123 44 00	54	35.0	2,061	gy. oz	Do.
2691H	....do...	36 25 30	124 02 50	56	34.8	2,112	gy. oz	Do.
2694H	....do...	36 09 00	124 55 30	59	35.0	2,434	br. & gy. oz	Do.
2695H	....do...	36 03 00	125 13 00	57	35.0	2,430	br. oz	Do.
2696H	Oct. 13	35 58 00	125 31 00	57	35.0	2,547	br. & gy. oz	Do.
2698H	....do...	35 47 30	126 05 00	62	35.0	2,566	br. oz	Do.
2767H	Oct. 23	36 47 10	122 07 55	58	44.8	202	gn. m. s	Do.
2768H	....do...	36 47 10	122 08 20	58	......	373	gn. m. s	Do.
2774H	....do...	36 47 10	122 15 50	56	......	469	gn. m. s	Do.
2775H	....do...	36 47 10	122 17 05	56	37.7	607	gn. m. s	Do.
2776H	....do...	36 46 10	122 18 20	57	......	621	gn. m. s	Do.
2844H	Nov. 13	28 33 30	144 37 00	71	......	2,821	br. oz	Do.
2848H	Nov. 14	28 12 20	145 13 00	72	......	2,728	br. oz	Do.
2851H	....do...	27 54 00	145 45 30	72	35.2	2,782	br. oz	Do.
2913H	Nov. 20	22 11 00	156 09 00	77	35.4	2,640	br. m	Do.
2915H	....do...	22 55 30	156 29 30	77	......	2,868	br. m	Do.
2916H	....do...	21 47 30	156 39 00	77	35.3	2,878	br. m	Do.
2917H	Nov. 21	21 39 00	156 48 30	77	......	2,615	br. m. fne. s	Do.
2919H	....do...	21 29 30	156 59 30	77	35.5	2,056	br. m. fne. s	Do.
2920H	....do...	21 21 00	157 09 00	77	......	570	br. m. fne. s	Do.
2921H	....do...	21 19 00	157 13 30	77	......	347	br. m. fne. s	Do.
2922H	....do...	21 18 30	157 19 00	77	44.8	268	gy. s	Do.
2995H	Dec. 5	21 18 00	157 29 00	76	......	308	fne. wh. s	Do.
2996H	....do...	21 20 30	157 25 00	76	......	407	fne. gy. s	Do.
2998H	....do...	21 26 00	157 17 00	76	......	508	fne. gy. s	Do.
2999H	....do...	21 27 00	157 15 00	76	......	549	fne. gy. s	Do.
3000H	....do....	21 29 30	157 12 00	76	......	1,557	gy. m. fne. s	Do.
3001H	....do....	21 32 30	157 08 00	74	35.0	11,792	gy. m. fne. s	Do.
3007H	Dec. 12	21 20 00	157 19 00	74	......	323	fne. gy. s	Do.
3008H	....do....	21 23 00	157 14 30	74	......	547	gy. m. fne. s	Do.
3009H	....do....	21 24 00	157 12 00	74	......	603	gy. m. fne. s	Do.
3010H	....do....	21 25 00	157 10 00	74	36.0	11,116	gy. m. fne. s	Do.
3012H	....do...	21 28 30	157 04 00	73	......	2,067	br. m. fne. s	Do.
3013H	....do...	21 32 30	156 54 00	73	35.0	31,807	br. m. s	Do.
3015H	....do...	21 41 00	156 32 30	73	......	2,966	br. m. fne. s	Do.
3018H	Dec. 13	21 56 00	155 57 30	74	......	2,915	br. oz	Do.
3190H	1892. Jan. 14	35 42 00	124 33 30	59	34.0	92,312	br. & gy. oz	Do.
3191H	Jan. 15	35 47 30	124 21 30	54	......	2,223	br. & gy. oz	Do.
3192H	....do...	35 53 00	124 09 30	54	......	2,149	br. & gy. oz	Do.

Hydrographic stations—Continued.

Station.	Date.	Locality.		Surface temperature.	Bottom temperature.	Depth.	Kind of bottom.	Remarks.
		Lat. N.	*Long. W.*					
	1892.	° ′ ″	° ′ ″	°*F.*	°*F.*	*Fms.*		
3193H	Jan. 15	35 58 30	123 57 30	54	34.0	92,169	gy. oz.........	Cable survey, California to Hawaiian Islands and return.
3194H	....do...	36 04 00	123 46 00	55	......	2,107	gy. oz.........	Do.
3195H	....do...	36 09 30	123 34 00	54	......	1,974	gy. oz.........	Do.
3196H	....do...	36 15 00	123 22 00	52	35.0	1,895	gy. oz.........	Do.
3198H	....do...	36 25 00	123 00 00	52	......	1,725	gy. oz.........	Do.
3199H	....do...	36 29 30	122 50 30	52	35.0	1,666	gy. oz.........	Do.
3200H	....do...	36 34 00	122 41 00	52	......	1,513	gn. m.........	Do.
3201H	....do...	36 38 00	122 31 00	52	......	1,417	gn. m.........	Do.
3202H	....do...	36 40 00	122 26 00	52	36.0	11,053	gn. m. fne. s...	Do.
	1893.							
3263H	July 6	51 00 00	176 04 00	44	37.0	32,039	gy. m. s.......	Off Alaska.
3267H	July 7	50 03 00	174 30 00	49	35.0	2,802	gy. oz.........	Do.
3361H	Aug. 7	58 01 00	175 41 00	46	35.0	21,367	gn. m. fne. s...	Do.
3399H	Aug. 20	54 38 00	175 27 00	49	35.0	12,041	gn. m. s.......	Do.
	1895.							
3565H	July 6	56 56 00	169 06 00	44	35.0	1,866	bu. m. oz.....	Bering Sea, between Pribilof and Commander islands.
3568H	....do...	57 35 00	170 24 00	43	38.0	1,537	br. oz. g......	Do.
3569H	....do...	57 41 00	170 39 00	42	38.0	609	br. oz. s......	Do.
3571H	....do...	57 53 00	171 09 00	42	36.0	5,696	gn. m. oz.....	Do.
3604H	Aug. 12	54 46 00	169 29 00	45	35.0	21,355	gn. oz.........	Bering Sea, between Pribilof and Aleutian islands.
3635H	Aug. 21	55 44 00	168 47 00	45	37.8	141	gy. s..........	Do.
	1896.							
3663H	Aug. 10	54 51 00	163 46 00	49	35.2	3,117	br. m. fne. dk. s.	Between Bering Island and Kamchatka.
3666H	....do...	54 32 30	161 58 30	44	37.4	586	br. m. fne. s. p.	Do.
3669H	Aug. 21	48 43 00	151 31 00	41	36.7	425	crs. dk. s.....	Along Kuril Chain.
3671H	Aug. 22	48 32 00	154 55 00	37	......	106	brk. sh.......	Do.
3683H	Aug. 26	47 33 00	152 07 00	39	35.2	1,712	fne. gy. s......	Sea Okhotsk.
3684H	....do...	47 36 00	151 46 00	53	......	1,830	br. m. dk. s...	Do.
3687H	Aug. 27	47 50 00	149 42 00	50	36.0	1,843	bn. y. m. fne s	Do.
3688H	....do...	47 55 30	148 56 00	55	35.8	1,562	br. m. fne. s...	Do.
3689H	....do...	48 01 30	148 16 30	55	36.0	1,426	bn. m. fne. s..	Do.
3690H	....do...	48 08 00	147 34 00	56	36.0	964	lt. m. qtz. s...	Do.
3693H	Aug. 28	48 27 45	145 20 30	56	33.0	155	bn. m. vol. s..	Do.
3694H	....do...	48 31 48	144 54 51	48	35.0	27	fne. g. r. sh...	Do.
3699H	Sept. 3	47 20 30	145 54 00	56	35.9	1,584	gn. m. fne. s...	Do.
3701H	....do...	46 35 00	146 49 00	55	36.0	1,820	lt. br. m. s....	Do.
3702H	....do...	46 15 00	147 07 00	55	35.8	1,817	br. m. fne. s...	Do.
3703H	Sept. 4	45 48 00	147 22 00	54	36.0	1,825	gn. m. fne. s...	Do.
3704H	....do...	45 40 00	147 28 00	53	35.9	1,761	gn. m. fne. s...	Do.
3705H	....do...	45 31 30	147 32 30	54	36.0	1,078	br. m. fne. s...	Do.
3706H	....do...	45 23 00	147 39 30	54	36.0	1,107	br. m. fne. s...	Do.
3712H	Sept. 6	45 21 00	146 27 00	58	35.8	1,744	gn. m. fne. s...	Do.
3714H	Sept. 7	45 25 00	145 02 00	57	35.9	1,649	gn. m. s.......	Do.
	1900.							
4013H	June 3	Inuboe Saki light, S. 74° W. 76 miles.		72	......	1,750	vol. s. part....	East coast Honshu Island. Japan.
4014H	....do...	Inuboe Saki light, S. 73° W. 96 miles.		75	......	3,800	vol. s. part....	Do.
4019H	June 24	Cape Kosloff, N. 15° W. and Cape Tschipunski, S. 82° W., each about 72 miles.		45	35.0	2,991	gn. m. vol. s..	Cape Tschipunski, Kamchatka, east across Bering Sea.
4020H	....do...	SE. end Bering Island NE. and Cape Kronotski NW., each about 108 miles.		47	35.0	1,804	gy. vol. s......	Do.
4021H	June 26	W. end Attu Island S. 90 miles.		45	35.0	2,166	fne. yl. vol. s..	Do.
4022H	June 27	54 31 00	179 21 00	45	38.0	282	gn. m. fne. vol. s.	Do.
4023H	....do...	54 31 00	179 30 00	45	37.0	636	gn. m. vol. s. wh. sp.	Do.
4024H	....do...	54 24 20	179 24 00	54	37.7	454	gn. m. fne. vol. s.	Do.

Hydrographic stations—Continued.

Station.	Date.	Locality.		Surface temperature.	Bottom temperature.	Depth.	Kind of bottom.	Remarks.
	1900.	*Lat. N.* ° ′ ″	*Long. W.* ° ′ ″	° *F.*	° *F.*	*Fms.*		
4025H	June 27	54 18 00	179 14 00	45	37.2	536	gy. m. fne. vol. s.	Cape Tschipunski. Kamchatka, east across Bering Sea.
4027H	....do...	54 22 00	179 08 00	45	......	708	gy. s	Do.
4028H	....do...	54 40 00	179 08 00	45	......	310	gy. vol. s. wh. sp.	Do.
4029H	....do...	54 47 20	179 08 00	45	......	913	gy. s. c	Do.
4430H	Gull Inlet, S. coast Santa Cruz Island, N. 40° E. 2.7′.					197	....	
4442H	Point Pinos light-house S. 67° W. 4.6′ distant.					26	....	
4447H	Point Pinos light-house S. 21° W. 4.5′ distant.					52	....	
4457H	Point Pinos light-house S. 21° W. 6.1′ distant.					46	....	
4476H	Point Pinos light-house S. 22° W. 9.4′ distant.					39	....	
4502H	Santa Cruz light-house N. 65° W. 8.9′ distant.					11	....	
4503H	Santa Cruz light-house S. 81° W. 3.8′ distant.					7	....	
4504H	Santa Cruz light-house S. 89° W. 4.6′ distant.					10	....	
4505H	Santa Cruz light-house N. 85° W. 5.8′ distant.					10	....	
4506H	Santa Cruz light-house N. 81° W. 6.9′ distant.					9	....	
		Lat. S.	*Long. W.*					
4507H	Nov. 12	5 43 06	81 43 08	.....	......	2,312	....	
4508H	....do...	5 46 05	81 26 09	.....	......	685	....	
4516H	Dec. 22	26 54 08	109 16 04	.....	......	1,627	....	
4517H	....do...	26 50 09	109 12 05	.....	......	1,723	....	
4555H	Point Pinos light-house S. 63° E. 3.4′ distant.					66	....	
		Lat. N.	*Long. W.*					
4567H	Oct. 6	37 25 00	122 26 00	.....	......	28	....	
4568H	....do...	36 45 00	122 02 00	.....	......	486	....	
4571H	Oct. 7	33 40 00	119 35 00	.....	......	825	....	
4590H	Oct. 13	18 50 00	104 50 00	.....	......	1,038	....	

The above stations, 4430 to 4590, represent material obtained during the California coast survey of 1904. Part of the material was destroyed by fire. The residue came into my hands after the other work of this report had been tabulated and is therefore given separately. In most instances the position is given by the true bearing of some shore object taken from the vessel.

DREDGING AND TRAWLING STATIONS.

Station.	Date.	Locality.		Surface temperature.	Bottom temperature.	Depth.	Kind of bottom.	Remarks.	Instrument used.
		Lat. S. ° ′ ″	*Long. W.* ° ′ ″	°*F.*	°*F.*	*Fms.*			
	1888.								
2807	Apr. 4	00 24 00	89 06 00	79	38.5	812	glob. oz. co. m.	Galapagos Island.	L. B. T.
2808	....do...	00 36 30	89 19 00	79	39.9	634	co. s........	....do............	Do.
		Lat. N.	*Long. W.*						
2823	Apr. 30	24 18 00	110 22 00	73	......	26.5	brk. sh......	Gulf of California.	L. B. T.
2835	May 4	26 42 30	113 34 15	56	......	5.5	gn. m.......	Off Lower California.	Ship dredge.
2844	July 28	53 56 00	165 40 00	48	42.0	54	gy. s.......	Off Alaska........	L. B. T.
2848	July 31	55 10 00	160 18 00	49	41.0	110	gn. m........	.....do............	Do.
2851	Aug. 4	54 55 00	159 52 00	51	44.8	35	gy.s. brk. sh.	.....do............	Do.
2859	Aug. 29	55 20 00	136 20 00	60	34.9	1,569	gy. oz........	.....do............	Do.
2860	Aug. 31	51 23 00	130 34 00	58	36.5	876	gn. m........	.....do............	Do.
2866	Sept. 20	48 09 00	125 03 00	59	43.2	171	gy. s........	British Columbia.	Do.
2871	Sept. 23	46 55 00	125 11 00	62	38.4	559	br. oz........	Off Washington..	Do.
2882	Oct. 13	46 09 00	124 22 30	60	45.8	68	gy. s........	Off Oregon.......	Do.
2885	Oct. 18	45 56 00	124 02 00	60	49.0	30	fne. gy. s....	.....do............	Do.
	1889.								
2919	Jan. 17	32 17 00	119 17 00	59	38.0	984	gy. m.......	Off southern California.	Do.
2923	Jan. 19	32 40 30	117 31 30	59	39.0	822	gn. m........	.....do............	Do.
2929	Jan. 26	32 27 30	117 26 30	58	......	623	gn. m........	.....do............	S. B. T.
3091	Sept. 8	45 32 00	124 19 30	56	......	87	gn. m.......	Off Oregon.......	L. B. T.
	1890.								
3097	Mar. 5	37 59 08	122 25 45	51	......	12	bu. m.......	Off central California.	Do.
3346	Sept. 22	45 30 00	124 52 00	54	37.3	786	gn. m.......	Off Washington..	Do.
	1891.								
3361	Feb. 25	6 10 00	83 06 00	82	36.6	1,471	gn. oz.......	Off Panama......	Do.
	1893.								
3513	Aug. 1	58 27 00	169 01 00	43	......	35	fne. s. gn. m.	Bering Sea........	B. T. mud bag.
3520	Aug. 3	59 28 00	170 57 00	43	32.2	38	fne. s. gn. m.	.....do............	Do.
3526	Aug. 5	57 31 00	170 57 00	44	38.9	49	fne. s. dk. m.	.....do............	R. D.
	1894.								
3570	Mar. 21	San Diego Bay, Cal.		57	......	2	fne. s. oysters.	San Diego Bay....	Boat dredge.
	1895.								
3603	Aug. 11	55 23 00	170 31 00	45	35.1	1,771	bu. oz.......	Bering Sea........	L. B. T., surface and intermediate nets.
3604	Aug. 12	54 54 00	168 59 00	45	35.2	1,401	gn. oz..........	.....do............	Do.
3607	Aug. 18	54 11 30	167 25 00	45	35.9	987	gn. m. bk. lav. s.	.....do............	Do.
3611	Aug. 22	56 45 00	167 25 00	46	34.6	50	gn. m. s.....	.....do............	Do.
	1897.								
3671	Apr. 21	37 00 00	122 20 00	50	......	56	gn. m. s.....	Monterey Bay....	L. B. T.
	1900.								
3696	May 5	Tsuragi Saki light, S. 80° W., 4.3 miles.		64	......	250 110	gn. m. fne. s.	Off Honshu Island, Japan.	8′ Tnr.
3698	....do...	Manazuru Zaki, N. 8° W. 4.5 miles.				153	gn. m. vol.. a. s.	.....do............	Do.
		Lat. N.	*Long. E.*						
3784	June 27	54 32 00	178 31 00	45	......	85	gn. m. fne. gy. s.	N. of Aleutian Islands.	Do.
3785	....do...	Rat Island, Aleutian Chain, S. 150 miles.		45	......	270	gy. s. brk. sh.	....do............	Do.
		Lat. N.	*Long. W.*						
3786	....do...	54 47 20	178 54 00	46	......	2,106	gy. s. yl. m..	.....do............	Do.

BIBLIOGRAPHY.

The following bibliography is intended to cover only the articles cited in the accompanying paper. In the literature of the diatoms a large proportion of the citations are to separates and an attempt has been made to correlate these with the publication in which they were originally issued, citing only the latter in a uniformly abbreviated style. For the convenience of students references as full as at present practicable are inserted under each title to the libraries in Washington containing the work. These libraries, however, have not been thoroughly searched for diatom literature and it is probable that many of the works may be found in other of the libraries than those indicated. In case of a single work reference has been made to the library of Northwestern University, Evanston, Ill., where it is known to exist complete. The abbreviations, as far as they concern Washington libraries, are based on those used in A Union List of Periodicals, Transactions, and Allied Publications in the Libraries of the District of Columbia, published by the Library of Congress in 1901. The abbreviations are as follows:

AGR.	Department of Agriculture Library.
FISH.	Bureau of Fisheries Library.
GS.	Geological Survey Library.
LC.	Library of Congress.
MANN.	Library of Dr. Albert Mann, George Washington University.
NM.	National Museum Library.
NW. U.	Northwestern University Library, Evanston, Ill.
PAT.	Patent Office Library.
SC.	Smithsonian Collection, Library of Congress.
SM.	Smithsonian Institution Library.
SURG.	Surgeon-General's Library.

For the location of serials containing articles included in the bibliography consult the abbreviation of the serial in its alphabetical sequence. An asterisk (*) after an abbreviation for a library indicates that only the separate of the accompanying article is included in that library.

Serials and original articles in the bibliography not accompanied by an abbreviation for a library have not been consulted and could not be located in Washington.

Abh. Schl. Ges. Vaterl. Cult. Abhandlungen der schlesischen gesellschaft für vaterländische cultur. Abtheilung für naturwissenschaften und medicin. SC.

Janisch, C. **1861^2**: 150–164. 1861. **1862^2**: 1–29. 1862.

Agardh, CARL ADOLF. Synopsis algarum Scandinaviae, adjecta dispositione universali algarum. xl, 135 p. Lundae, ex officina Berlingiana, 1816. 20 cm. AGR.

Agardh, CARL ADOLF. Species algarum rite cognitae, cum synonymis, differentiis specificis et descriptionibus succinctis. v. **1**: 5 p. l. 531 p. Gryphiswaldiae, sumtibus Ernesti Maurittii, 1823. v. **2**: Sectio prior, 1 p. l. 189 p. Gryphiae, sumtibus Ernesti Mauritii 1828. 19 cm. GS. AGR.

v. 1 originally published in 2 pts. Lundae, 1817–20.

GS copy of v. 1 has 2 additional title-pages: p. 1–168 dated 1821; p. 169–531 dated 1822. (Ed. nova.)

Agardh, Carl Adolf. Systema algarum. Adumbravit C. A. Agardh. xxxviii, 312 p. Lundae, Literis Berlingianis, 1824. 16½ cm. Agr.

Agardh, Carl Adolf. Conspectus criticus Diatomacearum. pt. I–IV. 66 p. 8°. Lundae, 1830–32.

Am. Journ. Micr. The American Journal of Microscopy and Popular Science. Agr.
Cox, J. D. **3**: 97–101; 125–130. 1878. **4**: 97–100. 1879.
Grunow, A. **3**: 101–105. 1878.
Kitton, F. **3**: 247–250. 1878.
Smith, H. L. **2**: 99–103. 1877.

Am. Journ. Sci. The American Journal of Science and Arts. NM. GS. Agr.
Bailey, J. W. I. **35**: 118–124. 1838. **42**: 88–105. 1842. **43**: 321–332. 1842. **46**: 137–141; 297–313. 1844. **48**: 321–343. 1845. II. **22**: 1–6. 1856.
Johnson, A. S. **13**: 33. 1852.

Am. Mo. Micr. Journ. The American Monthly Microscopical Journal. Agr.
Boyer, C. S. **20**: 105–108. 1899.

Anal. Soc. Españ. Hist. Nat. Anales de la Sociedad Español de Historia Natural. SC.
Delas y de Gayola, F. **12**: 383–392. 1883.
Truan y Luard, A. **13**: 307–364. 1884. **14**: 239–256. 1885.

Anders. Svenska Växtv. Hist. Anderson, Gunnar. Svenska växtvarldens historia i korthet framställd. (Från Stockholms högskolas populära föreläsningar.) 2 p. l. 136 p. 56 f. 1 map. Stockholm, P. A. Norstedt & Söners. 1896. 25½ cm. GS.
Diatomaceae p. 5, 34–57. f. 2, 27 & 45.

Ann. Jard. Bot. Buitenz. Annales du Jardin Botanique de Buitenzorg. GS.*
Leuduger-Fortmorel, G. **11**: 1–60. 1892.

Ann. Mag. Nat. Hist. The Annals and Magazine of Natural History, including zoology, botany, and geology. (Being a continuation of the "Annals" combined with London and Charlesworth's "Magazine of Natural History.") Agr.
Greville, R. K. II. **15**: 252–261. 1855. III. **16**: 1–7. 1865.
Norman, G. II. **20**: 158–159. 1857.
Ralfs, J. **11**: 447–457. 1843. **12**: 104–111; 270–276; 346–352; 457–467. 1843. **13**: 457–461; 489–493 1844. **16**: 109–112. 1845.
Smith, W. II. **7**: 1–14. 1851. **9**: 1–12. 1852. **15**: 1–9. 1855. **19**: 1–13. 1857.
Thwaites, G. H. K. **20**: 9–11. 1847. II. **1**: 161–172. 1848.
Williamson, W. C. II. **1**: 321–322. 1848.

Ann. Soc. Malacol. Belg. Annales de la Société malacologique de Belgique. Agr.
Deby, J. **11**: 69–90. 1876.

Ann. Soc. Phyt. et Micr. Belg. Annales de la Société phytologique et micrographique de Belgique. Anvers. 1 v: 1864–1869. all pub.
Brebisson, A..201. 1868. (Van Heurckia.)

Anton. & Bon. Antonelli, Giovanni et Bonetti, Filippo. Le Diatomee fossili di Tor di Valle nei Dintorni di Roma. **Mem. Accad. Lincei 9**: [1–14?]. 1893.
Reprinted 14 p. Roma, Filippo Cuggiani, 1893. 29 cm. GS.*

Arnott, George Arnott Walker-. On "species" of Diatomaceae. **Quart. Journ. Micr. Sci. 3**: 307–312. 1855.

Arnott, George Arnott Walker-. On Rhabdonema, and a new allied genus. **Quart. Journ. Micr. Sci. 6**: 87–93. 1858.

Arnott, George Arnott Walker-. On Arachnoidiscus. **Quart. Journ. Micr. Sci. 6**: 159–165. 1858.

Arnott, George Arnott Walker-. On the structure of Amphora, a genus of Diatomaceae, and the diagnosis of its species. **Quart. Journ. Micr. Sci. 6**: 184–186. 1858.
A résumé of the preliminary notes appeared in **Proc. Roy. Soc. Edinb. 4**: 74–77. 1858.

Arnott, George Arnott Walker-. Note on Arachnoidiscus, Pleurosigma, Amphiprora, Eunotia, and Amphora. **Quart. Journ. Micr. Sci. 6**: 195–206. 1858.

Arnott, GEORGE ARNOTT WALKER-. Note on Campylodiscus hodgsonii. **Trans. Micr. Soc. Lond. N. Ser. 6:** 85–87. 1858.

Arnott, GEORGE ARNOTT WALKER-. Bermuda Tripoli. **Quart. Journ. Micr. Sci. 7:** 254. 1859.

Arnott, GEORGE ARNOTT WALKER-. On Cyclotella. **Quart. Journ. Micr. Sci. 8:** 244–248. 1860.

Atti Accad. Lincei. Atti dell' Accademia Pontificia de' nuovi Lincei. Rome.
Lanzi, M. 47: [1–7]. 1894. GS.*

Atti Soc. Critt. Ital. Atti della Società crittogamologica Italiana residente in Milano. (R. Orto Botanico di Brera.) AGR.
Lanzi, M. II. 8: 122–129. 1883.

Bailey, JACOB WHITMAN. On fossil Infusoria, discovered in peat earth, at West Point, N. Y., with some notices of American species of Diatomae. **Am. Journ. Sci. 35:** 118–124. pl. 2. 1839.

Bailey, JACOB WHITMAN. A sketch of the Infusoria, of the family Bacillaria, with some account of the most interesting species which have been found in a recent or fossil state in the United States. **Am. Journ. Sci. 41:** 284–305. pl. 3. 1841. **42:** 88–105. pl. 2. 1842. **43:** 321–332. pl. 5. 1842.

Bailey, JACOB WHITMAN. Account of some new Infusorial forms discovered in the fossil Infusoria from Petersburg, Va., and Piscataway, Md. **Am. Journ. Sci. 46:** 137–141. pl. 3. 1844.

Bailey, JACOB WHITMAN. Notice of a memoir by C. G. Ehrenberg, "On the extent and influence of microscopic life in North and South America." **Am. Journ. Sci. 46:** 297–313. 1844.
See **Ehrenberg,** C. G. **Phys. Abh. Akad. Wiss. Berl. 1841:** 291–446. 1843.

Bailey, JACOB WHITMAN. Fossil freshwater Infusoria from Oregon. **Fremont, Rep. Explor. Exped. 1842–4.** 302. pl. 5. 1845.

Bailey, JACOB WHITMAN. Notice of some new localities of Infusoria, fossil and recent. **Am. Journ. Sci. 48:** 321–343. pl. 4. 1845.

Bailey, JACOB WHITMAN. Microscopical examination of soundings made by the U. S. Coast Survey off the Atlantic coast of the U. S. **Smithson. Contr. Knowl.** $\mathbf{2^{3}}$: 1–15. pl. 1. 1851.

Bailey, JACOB WHITMAN. Microscopical observations made in South Carolina, Georgia and Florida. **Smithson. Contr. Knowl.** $\mathbf{2^{8}}$: 1–48. pl. 1–3. 1851.

Bailey, JACOB WHITMAN. Notes on new species and localities of microscopical organisms. **Smithson. Contr. Knowl. 7:** 1–16. pl. 1. 1854.

Bailey, JACOB WHITMAN. List of Diatomaceae, collected by the United States Exploring Expedition under the command of Capt. Wilkes, U. S. N. **Proc. Acad. Phila. 6:** 431–432. 1854.

Bailey, JACOB WHITMAN. Notice of microscopic forms found in the soundings of the sea of Kamtschatka. **Am. Journ. Sci. II. 22:** 1–6. pl. 1. 1856.

Bailey, LORING WOART. Notes on new species of microscopical organisms, chiefly from the Para River, South America. **Bost. Journ. Nat. Hist. 7:** 329–352. pl. 7–8. 1862.

Bail. & Harv. in Wilkes Explor. Exped. *See* **U. S. Exploring Expedition.** *See also* **Harvey and Bailey,** *and* **Bailey,** J. W.

Belloc, EMILE. Les Diatomées de Luchon et des Pyrénées centrales. **Rev. de Comm. 3:** [1–58]. pl. 3. 1887. AGR.*

Ber. Akad. Wiss. Berl. Bericht über die zur Bekanntmachung geeigneten Verhandlungen der Königl. Preuss. Akademie der Wissenschaften zu Berlin.
1836–1847 Nw. U.
1848–1855 SC.

Ehrenberg, C. G. **1840**: 157–162. 1841. **1843**: 133–136; 259–272. 1844. **1844**: 57–97; 182–207; 253–275. 1845. **1845**: 53–87. 1846. **1848**: 1–5. 1849.

Ber. Deut. Bot. Ges. Berichte der deutschen Botanischen Gesellschaft. Agr.

Schütt, F. **13**: 35–48. 1895.

Bessey, Charles Edwin. The modern conception of the structure and classification of diatoms. With a revision of the tribes and a rearrangement of the North American genera. **Trans. Am. Micr. Soc. 21**: 61–85. pl. 5. 1900.

Bih. Sv. Vet.-Akad. Handl. Bihang till Kongl. Svenska Vetenskaps-Akademiens Handlingar. Agr.

Brun, J. Bd. **26**. Afd. III^{18}: 1–22. 1901.
Cleve, P. T. **5**^{6}: 1–22. 1878. **1**^{11}: 1–13. 1873. **1**^{13}: 1–28. 1873.
Lagerstedt, N. S. W. **1**^{14}: 1–52. 1873. **3**^{16}: 1–66. 1876.

Blake, William Phipps. Arizona diatomite. **Trans. Wisc. Acad. 14**: 107–111. pl. 3–8. 1903.

Bleisch (Max?). Ueber Plaurostaurum. **Hedwigia, 2**: 19–20. pl. 3. 1860.

Bleisch (Max?). Pinnularia chilensis. **Hedwigia, 2**: 28. pl. 4. f. 1–2. 1860.

Bleisch (Max?). Ueber zwei Campylodiscus. **Hedwigia, 2**: 29–33. pl. 5. 1860.

Bory de Saint Vincent, Jean Baptiste Marcellin. Mémoire sur l'établissement d'une nouvelle famille dans la classe des infusoires, sous le nom de Bacillariées. **Bull. Soc. Philom. Paris,** III. 9. 1823.

Bory, Dict. Hist. Nat. Dictionnaire classique d'Histoire naturelle, par Messieurs Adouin, Isid. Bourdon, Ad. Brongniart, De Candolle, Daudebard de Férussac, A. Desmoulins, Drapiez, Edwards, Flowrens, Geoffroy de Saint-Hilaire, A. de Jussieu, Kunth, G. de Lafosse, Lamouroux, Latreille, Lucas fils, Presle-Duplessis, C. Prévost, A. Richard, Thiébaut de Berneaud, et Bory de Saint-Vincent. 17 v. Paris, Baudoin Frères, [etc. etc.] 1822–1831. Agr.

v. 17 contains 160 plates, mostly colored, and a map.
Diatomaceae scattered throughout the work in an alphabetical arrangement. pl. 51. f. 1–2. 54. f. 1, 3.

Bost. Jour. Nat. Hist. Boston Journal of Natural History. Agr.

Bailey, L. W. **7**: 329–352. 1862.

Boyer, Charles S. New species of Diatoms. **Proc. Acad. Phila. 1898**: 468–470. pl. 24. 1898.

Boyer, Charles S. Seven new species of Diatoms. **Am. Mo. Micr. Jour. 20**: 105–108. pl. 1899.

Boyer, Charles S. The biddulphoid forms of North American Diatomaceae. **Proc. Acad. Phila. 1900**: 685–748. 1901.

Brébis. Brébisson, Alphonse de. Note sur quelques Diatomées marines rares ou peu connues, du littoral de Cherbourg. **Mém. Soc. Sci. Nat. Cherb. 2**: 241–258. pl. 1854.

Brébis. Brébisson, Alphonse de. Description de quelques nouvelles Diatomées observées dans le guano du Pérou, formant le genre Spatangidium. **Bull. Soc. Linn. Norm. 2**: 292–298. pl. 3. 1857.

Reprinted in **Ann. Sci. Nat.** IV. Bot. **9**: 91–96. pl. 4. 1858.

Brébis. Brébisson, Alphonse de. Notes on some French Diatomaceae. **Journ. Quek. Micr. Club, 2**: 37–43. pl. 1. 1870.

Bréb. et God. Brébisson, Alphonse de, et Godey ( ). Algues des environs de Falaise. **Mém. Soc. Acad. Fal. 1835**: 1–63; 256–269. 8 pl. (1836?)

Bréb. et God. Consid. Diat. Brébisson, Alphonse de, et Godey ( ). Considerations sur les Diatomées et essai d'une classification des geners et des espèces appartenant á cette famille. 20 p. Falaise. 1838.

Bright. Brightwell, Thomas. On the genus Triceratium, with descriptions and figures of the species. **Quart. Journ. Micr. Sci. 1:** 245–252. pl. 4. 1853.

Bright. Brightwell, Thomas. On the filamentous, long-horned Diatomaceae, with a description of two new species. **Quart. Journ. Micr. Sci. 4:** 105–109. pl. 7. 1856.

Bright. Brightwell, Thomas. Further observations on the genus Triceratium, with descriptions and figures of new species. **Quart. Journ. Micr. Sci. 4:** 272–276. pl. 17. 1856.

Bright. Brightwell, Thomas. Remarks on the genus "Rhizosolenia’ of Ehrenberg. **Quart. Journ. Micr. Sci. 6:** 93–95. pl. 5. 1858.

Bright. Brightwell, Thomas. Further observations on the genera Triceratium and Chaetoceros. **Quart. Journ. Micr. Sci. 6:** 153–155. pl. 8. 1858.

Bright. Brightwell, Thomas. On some of the rarer or undescribed species of Diatomaceae. **Quart. Journ. Micr. Sci. 7:** 179–181. pl. 9. 1859. **8:** 93–96. pl. 5. 1860.

Brun, Diat. Alp. Brun, Jacques. Diatomées des Alpes et du Jura et de la région Suisse et Française des environs de Genève. 2 p. l. 146 p. 9 pl. Paris, Georges Masson. 1880. 23cm. Mann.

Brun, Jacques. Diatomées espèces nouvelles marines, fossiles ou pélagiques. **Mém. Soc. Phys. et Hist. Nat. Genève 31**^{1}**:** 1–47. pl. 11–22. 1891.

Brun, Jacques. Liste rectificative [des Diatomées de Hongrie du Dr. Pantocsek]. **Le Diatomiste, 2:** 51–53. 1894.

Brun, Jacques. Diatomées, lacustres, marines ou fossiles, espèces nouvelles ou insuffisamment connues. **Le Diatomiste, 2:** 4 l. pl. 14–17. 1895.

The above article has no text and the four leaves with explanations of the plates are not numbered. The species are included in the index to v. **2** of Le Diatomiste, but the title of the article is not included. The Agr. copy of Le Diatomiste has plates 14–18 missing from v. 2. The above article is only known in Washington in Dr. Mann's library. It is probable that the article was originally issued with Le Diatomiste, with separate pagination as in Peragallo's monograph of Pleurosigma.

Brun, Jacques. Diatomées d'eau douce de l'île Jan Mayen et de la côte est du Groenland. **Bih. Sv. Vet.-Akad. Handl.** Bd. **26.** Afd. **III**^{18}: 1–22. pl. 1–2. 1901.

Brun & Temp. Brun, Jacques et Tempère, J. Diatomées fossiles du Japon. Espèces marines & nouvelles des calcaires argileux de Sendaï & de Yedo. **Mém. Soc. Phys. et. Hist. Nat. Genève, 30**^{9}: 1–75. pl. 1–8. 1889.

Bull. Acad. St. Pétersb. Bulletin de l'Académie Impériale des Sciences de St. Pétersbourg. Agr.

Weisse, J. F. **12:** 120–125. 1868.

Bull. Soc. Belg. Micr. Bulletins de la Société Belge de microscopie. Surg.

Deby, J. **4:** clxii–clxx. 1878.
Prinz, W. **7:** xlv–lvii. 1881.

Bull. Soc. Bot. Fr. Bulletin de la Société Botanique de France. Agr.

Petit, P. **23:** 372–383. 1876.

Bull. Soc. Hist. Nat. Toulouse. Bulletin. Société d'histoire naturelle de Toulouse. SC.

Peragallo, H. **18:** 189–272. 1884. **22:** 13–100. 1888.

Bull. Soc. Linn. Norm. Bulletin de la Société Linnéenne de Normandie. SC.

Brébisson, A. de. **2:** 292–298. 1857.

Bull. Soc. Philom. Paris. Bulletin des Sciences, par la Société Philomatique de Paris. Agr.

Bory, J. B. M. III. **9.** 1823

Bull. Torr. Club. Bulletin of the Torrey Botanical Club. NM. AGR.
Kain, C. H. **14:** 25-32; 141. 1887.
Kain, C. H. and Schultze, E. A. **14:** 25-32; 141. 1887. **16:** 71-76; 207-210. 1889.
Schultze, E. A. **14:** 69-73; 96; 109-114. 1887. **16:** 98-104. 1889.

C. Ag. Consp Diat.—Sp. Alg.—Syn. Alg. Scand.- Syst. Alg. *See* **Agardh,** C. A.

Card. & Dun. CARD, G. W. AND DUN, W. S. The diatomaceous earth deposits of New South Wales. **Rec. Geol. Surv. N. S. W. 5:** 128–148. pl. 12–15. 1897. GS.

Carp. Micro. CARPENTER, WILLIAM BENJAMIN. The microscope and its revelations, by the late William B. Carpenter, C. B., M. D., LL. D., F. R. S. Eighth edition in which the first seven and the twenty-third chapters have been entirely rewritten, and the text throughout reconstructed, enlarged and revised by the Rev. W[illiam] H[enry] Dallinger, D. Sc., D. C. L., LL. D., F. R. S., &c. xx. 1181 p. front. 22 pl. 817 fig. Philadelphia, P. Blakiston's Sons & Co. 1901. 23 cm. LC.
Diatomaceae, p. 587-625. pl. 10-12. f. 441-468.

Carruthers, WILLIAM. *See* **Gray,** J. E.

Castr. in Rep. Voy. Chall. Bot. CASTRACANE DEGLI ANTELMINELLI, CONTE ABATE FRANCESCO, in Report on the scientific results of the voyage of H. M. S. Challenger during the years 1873–76, under the command of Captain George S. Nares, R. N., F. R. S., and the late Captain Frank Tourle Thompson, R. N. Botany. [Diatomaceae.] v. 2. 4 p. l. iv, 178 p. 30 pl. 1886. AGR.

Chase, HARVEY H. *See* **Walker and Chase;** *also* **Habirshaw,** F.

Cleve, PEHR THEODOR. Diatomaceer från Spetsbergen. **Öfv. Kgl. Vet.-Akad. 24:** 661–669. pl. 23. 1868.

Cleve, PEHR THEODOR. Svenska och Norska Diatomacéer. **Öfv. Kgl. Vet.-Akad. Förhandl. 25:** 213–239. pl. 4. 1868.

Cleve, PEHR THEODOR. Examination of Diatoms found on the surface of the sea of Java. **Bih. Sv. Vet.-Akad. Handl. 1**^{11}**:** 1–13. pl. 1–3. 1873.

Cleve, PEHR THEODOR. On diatoms from the Arctic sea. **Bih. Sv. Vet.-Akad. 1**^{13}**:** 1–28. pl. 1–4. 1873.

Cleve, PEHR THEODOR. Diatoms from the West Indian archipelago. **Bih. Sv. Vet.-Akad. Handl. 58:** 1–22. pl. 1–5. 1878.

Cleve, PEHR THEODOR. On some new and little known diatoms. **Sv. Vet.-Akad. Handl. 18**^{5}**:** 1–28. pl. 1–6. 1881.

Cleve, PEHR THEODOR. Fårskvattensdiatomecéer frän Grönland och Argentinska republiken. **Öfv. Kgl. Vet.-Akad. 38**^{10}**:** 3–13. pl. 16. 1882.

Cleve, PEHR THEODOR. Diatoms collected during the expedition of the Vega. 1883. **in Nordensk. Vega Exped.** *See* **Nordenskiold,** A. E.

Cleve, PEHR THEODOR. On some fossil marine diatoms found in the Moravian "tegel" from Augarten, near Brun. **Journ. Quek. Micr. Club,** II. **2:** 165–177. pl. 12–13. 1885.

Cleve, PEHR THEODOR. Dictyoneis Cleve n. g. Note préliminaire. **Le Diatomiste, 1:** 14–17. 1890.

Cleve, PEHR THEODOR. Synopsis of the naviculoid diatoms. **Sv. Vet.-Akad. Handl. 26**^{2}**:** 1–194. pl. 1–5. 1894. **27**^{3}**:** 1–219. pl. 1–4. 1895.

Cleve, PEHR THEODOR. Notes on some Atlantic plankton-organisms. **Sv. Vet.-Akad. Handl. 34**^{1}**:** 1–22. pl. 1–8. 1900.

Cleve, PEHR THEODOR. The plankton of the North sea, the English channel and the Skagerak in 1899. **Sv. Vet.-Akad. Handl. 34**^{2}**:** 1–75. 1900.

Cleve, Pehr Theodor. Report on the plankton collected by the Swedish expedition to Greenland in 1899. **Sv. Vet.-Akad. Handl. 34**^{2}: 1–21. 1900.

Cleve & Grun. Cleve, Pehr Theodor und Grunow, Albert. Beiträge zur kenntniss der arctischen diatomeen. **Sv. Vet.-Akad. Handl. 17**^{2}: 1–121. pl. 1–7. 1880.

Cleve & Jentz. Cleve, Pehr Theodor und Jentzsch, Alfred. Ueber einige diluviale und alluviale diatomeenschichten norddeutschlands. **Schrift. Phys.-Ökon. Gesell. Königsb. 22**: 129–170. 1882.

Cox, Jacob Dolson. Isthmia nervosa. A study of its modes of growth and reproduction. **Am. Journ. Micr. 3**: 97–101; 125–130. f. 1–6. 1878.

Cox, Jacob Dolson. Surirella craticula, an abnormal form of Navicula cuspidata. **Am. Journ. Micr. 4**: 97–100. f. 1–2. 1879.

Cox, Jacob Dolson. Deformed diatoms. **Proc. Am. Soc. Micr. 12**: 178–183. f. 1–19. 1891.

Deby, Julien. Note sur l'argile des polders suivie d'une liste des fossiles qui y ont été observés dans la Flandre occidentale. **Ann. Soc. Malacol. Belg. 11**: 69–90. pl. 1876.

Deby, Julien. Synonymie des diatomées décrites dans le "Conspectus criticus diatomacearum," de Ch. Ad. Agardh. **Bull. Soc. Belg. Micr. 4**: clxii–clxx. 1878.

Deby, Julien. A bibliography of the microscope and micrographic studies, being a catalogue of books and papers in the library of Julien Deby. Part III. The Diatomaceae. Compiled with the cooperation of Frederic Kitton. 4 p.l. 67 p. London, David Bogue. 1882. 26½ cm. Surg.

Delás y de Gayola, Francisco de S. de. Nota sobre algunas diatomaceas recogidas en olot durante el verano de 1883. **Anal. Soc. Españ. Hist. Nat. 12**: 383–392. 1883.

Denkschr. Akad. Wien. Denkschriften der kaiserlichen akademie der wissenschaften. Mathematisch-naturwissenschaftlichen classe. Wien. Sm.

Grunow, A. **48**^{2}: 53–112. 1884.

De Toni, Syll. Alg. *See* **Toni,** J. B. de.

Le **Diatomiste;** journal spécial s'occupant exclusivement des diatomées et de tout ce qui s'y rattache, paraissant tous les trois mois par J. Tempère avec la collaboration de MM. J. Brun, P. Bergon, P. T. Cleve, E. Dutertre, E. Grove, Dr. P. Miquel, & H. Peragallo. June 1890–Mar. 1896. Paris, J. Tempère [etc. etc.] 2 v. 1890–96. 30 cm. Agr. GS.

Issued in 24 parts.
Brun, J. **2**: 51–53. 1894.
Cleve, P. T. **1**: 14–17. 1890.
Peragallo, H. **1**$^{4-5}$: 1–35. 1891. **1**$^{8-9}$: 79–82: 99–117. 1892.

Dillw. Brit. Conferv. Dillwyn, Lewis Weston. British Confervae; or colored figures and descriptions of the British plants referred by botanists to the genus Conferva. 3 p.l. 87, 6 p. 1 l. 109, A–G col. pl. Printed and sold by W. Phillips, George yard, Lombard street, London, 1809. 25½ cm.

Plates 1–109 accompanied by 1–2 unnumbered pages of descriptive text.
See **Kitton,** F.

Donk. Donkin, Arthur Scott. On the marine Diatomaceae of Northumberland, with a description of eighteen new species. **Trans. Micr. Soc. Lond. N. S. 6**: 12–34. pl. 3. 1858.

Donk. Donkin, Arthur Scott. On the marine Diatomaceae of Northumberland, with a description of several new species. **Quart. Journ. Micr. Sci. N. S. 1**: 1–15. pl. 1. 1861.

Donk. Donkin, Arthur Scott. On several new and rare species of fresh-water Diatomaceae discovered in Northumberland. **Quart. Journ. Micr. Sci. N. S. 9**: 287–296. pl. 13. 1869.

Donk. Brit. Diat. Donkin, Arthur Scott. The natural history of the British Diatomaceae. Parts I–III. (all published). 74 p. 12 l. 12 pl. 3 p. 1871–73. Agr.

Edinb. New Phil. Journ. The Edinburgh New Philosophical Journal, exhibiting a view of the progressive discoveries and improvements in the Sciences and the Arts. LC.

Greville, R. K. N. S. **10**: 25–30. 1859. **18**: 34–43; 181–187. 1863.

Ehrenb. Symb. Phys. Evertebr. Ehrenberg Christian Gottfried. Symbolae physicae seu icones et descriptiones animalium evertebratorum sepositis insectis quae ex itinere per Africam borealem et Asiam occidentalem. Berolini, ex officina academica, 1828. 50½ cm.

Pages not numbered. Diatomaceae scattered through signatures a–f of section designated Phytozoa, and plates 1–3. SC.

Ehrenb. Ehrenberg, Christian Gottfried. Über die entwickelung und lebensdauer der infusionsthiere; nebst ferneren beiträgen zu einer vergleichung ihrer organischen systeme. **Phys. Abh. Akad. Wiss. Berlin, 1831**: 1–54. pl. 1–4. 1832.

Ehrenb. Ehrenberg, Christian Gottfried. Über das massenverhältniss der jetzt lebenden kiesel-infusorien und über ein neues infusorien-conglomerat als polirschieser von Jastraba in Ungarn. **Phys. Abh. Akad. Wiss. Berlin, 1836**: 109–135. pl. 1–2. 1838.

Issued separately as "Die fossilen infusorien und die lebendige dammerde." Berlin, 1837.

Ehrenb. Infus. Ehrenberg, Christian Gottfried. Die infusionsthierchen als vollkommende organismen. Ein blick in das tiefere organische leben der natur. xviii p. 2 l. 548 p. 1 l. 65 pl. Leipzig, Leopold Voss, 1838. 46 cm. Surg.

Ehrenb. Ehrenberg, Christian Gottfried. Über die bildung der kreidefelsen und des kreidemergels durch unsichtbare organismen. **Phys. Abh. Akad. Wiss. Berlin, 1838**: 59–147. pl. 1–4. 1840.

Ehrenb. Ehrenberg, Christian Gottfried. Über noch jetzt zahlreich lebende thierarten der kreidebildung und den organismus der polythalmien. **Phys. Abh. Akad. Wiss. Berlin, 1839**: 81–74. pl. 1–4. 1841.

Ehrenb. Ehrenberg, Christian Gottfried. Erstlich über ausgezeichnete jetzt lebende peruanische und mexikanische meeres-infusorien, welche mit zur erlauterung räthselhafter fossiler formen der kreidebildung dienen. **Ber. Akad. Wiss. Berlin, 1840**: 157–162. 1841.

Ehrenb. Ehrenberg, Christian Gottfried. Verbreitung und einfluss der mikroskopischen lebens in Süd- und Nord-Amerika. **Phys. Abh. Akad. Wiss. Berlin, 1841**: 291–446. pl. 1–4. 1843.

Reviewed, with extracts by J. N. Bailey, Am. Journ. Sci. **46**: 297–313. 1844.

Ehrenb. Ehrenberg, Christian Gottfried. Über die weitere entwickelung der verbreitung und des einflusses des mikroskopischen lebens in Afrika. **Ber. Akad. Wiss. Berlin, 1843**: 133–136. 1844.

Ehrenb. Ehrenberg, Christian Gottfried. Über eine fortgesetzten beobachtungen des bedeutenden einflusses unsichtbar kleiner organismen auf die unteren stromgebiete, besonders der Elbe, Jahde, Ems und Schelde. **Ber. Akad. Wiss. Berlin, 1843**: 259–272. 1844.

Ehrenb. Ehrenberg, Christian Gottfried. Mittheilung über zwei neue lager von gebirgsmassen aus infusorien als meeres-absatz in Nord-Amerika und eine vergleichung derselben mit den organischen kreidegebilden in Europa und Afrika. **Ber. Akad. Wiss. Berlin, 1844**: 57–97. 1845.

Ehrenb. EHRENBERG, CHRISTIAN GOTTFRIED. Einige vorläufige resultate der untersuchungen der von der südpolreise des Capitain Ross, so wie von den Herren Schayer und Darwin zugekommenen materialen über das verhalten des kleinsten lebens in den oceanen und den grössten bisher zugänglichen tiefen des Weltmeers. **Ber. Akad. Wiss. Berlin, 1844:** 182–207. 1845.

Ehrenb. EHRENBERG, CHRISTIAN GOTTFRIED. Untersuchungen über die kleinsten lebensformen im Quellenlande des Euphrats und Araxes, so wie über eine an neuen formen sehr reiche marine tripelbildung von den Bermuda-inseln. **Ber. Akad. Wiss. Berlin, 1844:** 253–275. pl. 1. 1845.

Ehrenb. EHRENBERG, CHRISTIAN GOTTFRIED. Neue untersuchungen über das kleinste leben als geologisches moment. **Ber. Akad. Wiss. Berlin, 1845:** 53–87. 1846.

Ehrenb. EHRENBERG, CHRISTIAN GOTTFRIED. Passatstaub und blutregen. Ein grosses organisches unsichtbares wirken und leben in der atmosphäre. **Phys. Abh. Akad. Wiss. Berlin, 1847:** 269–460. pl. 1–6. 1849.

Ehrenb. EHRENBERG, CHRISTIAN GOTTFRIED. Über in dem magen eines peruanischen flussfisches als speise gefundene mikroskopische organismen. **Ber. Akad. Wiss. Berlin, 1848:** 1–5. 1849.

Ehrenb. Mikrog. EHRENBERG, CHRISTIAN GOTTFRIED. Mikrogeologie. Das erden und felsen schaffende wirken des unsichtbar kleinen selbständigen lebens auf der erde. 2 v. text, atlas. Leipzig, Leopold Voss, 1854. LC.

Text, xxviii, 374 p.
Atlas, 31 p. 40 pl. with explanatory leaves.

Ehrenb. EHRENBERG, CHRISTIAN GOTTFRIED. Über das mikroskopische leben der centralen landflächen mittel-Afrika's, nach Dr. Vogel's materialien. **Monatsb. Preuss. Akad. Wiss. Berlin, 1856:** 323–339. 1 pl. 1856.

Ehrenb. EHRENBERG, CHRISTIAN GOTTFRIED. Über die seit 27 jahren noch wohl erhaltenen organisations-präparate des mikroskopischen lebens. **Phys. Abh. Akad. Wiss. Berlin, 1862:** 39–74. pl. 1–3. 1863.

Ehrenb. EHRENBERG, CHRISTIAN GOTTFRIED. Über mächtige gebirgs-schichten vorherrschend aus mikroskopischen bacillarien unter und bei der stadt Mexiko. **Phys. Abh. Akad. Wiss. Berlin, 1869:** 1–66. pl. 1–3. 1870.

Ehrenb. EHRENBERG, CHRISTIAN GOTTFRIED. Über die wachsende kenntniss des unsichtbaren lebens als felsbildende bacillarien in Californien. **Phys. Abh. Akad. Wiss. Berlin, 1870:** 1–74. pl. 1–3. 1871.

Ehrenb. EHRENBERG, CHRISTIAN GOTTFRIED. Übersicht der seit 1847 fortgesetzten untersuchungen über das von der Atmosphäre unsichtbar getragene reiche organische leben. **Phys. Abh. Acad. Wiss. Berlin, 1871:** 1–150. pl. 1–2. 1872.

Ehrenb. EHRENBERG, CHRISTIAN GOTTFRIED. Mikrogeologische studien über das kleinste leben der meeres-tiefgründe aller zonen und dessen geologischen einfluss. **Phys. Abh. Akad. Wiss. Berlin, 1872:** 131–398. pl. 1–12. map. 1873.

Ehrenb. EHRENBERG, CHRISTIAN GOTTFRIED. Fortgesetzung der mikrogeologischen studien als gesammt-übersicht der mikroskopischen paläontologie gleichartig analysirter gebirgsarten der erde, mit specieller rücksicht auf den polycystinen-mergel von Barbados. **Phys. Abh. Akad. Wiss. Berlin, 1875:** 1–226. pl. 1–30. 1876.

Eng. & Pr. Pflanzenfam. ENGLER, ADOLF UND PRANTL, KARL ANTON EUGENE. Die natürlichen Pflanzenfamilien nebst ihren gattungen und wichtigeren arten insbesondere den nutzpflanzen, unter mitwirkung zahlreicher hervorragender fachgelehrten. Teil 1. Abteilung 1b. 153 p. 282 f. Leipzig, Wilhelm Engelmann, 1896. 25 cm. NM. AGR.

Peridiniales (p. 1–30) and Bacillariales (p. 31–150) by **Franz Schütt.**

Eulens. Eulenstein, Theodor.[a] On Homoeocladia in fresh water. **Quart. Journ. Micr. Sci. N. S. 4:** 172-173. 1864.

Eulens. Eulenstein, Theodor. Value of habitat as a distinctive species. **Quart. Journ. Micr. Sci. N. S. 5:** 65-66. 1865.

Eulen. Diat. Sp. Typ. Eulenstein, Theodor. Diatomacearum species typicae. (Exsiccata.) Stuttgart, 1868.

Fenzl, Eduard. Reise der österreichischen fregatte Novara um die erde in den jahren 1857, 1858, 1859, unter den befehlen des Commodore B. von Wüllerstorf-Urbair. Botanischer theil. v. text plates. Wien, aus der K. K. Hof- und Staatsdruckerei, 1870. 31½ cm. SC.

Bd. 1. Sporenpflanzen von A. Grunow, J. Krempelhuber, Dr. H. W. Reichardt, Prof. Dr. G. Mettenius, Dr. J. Milde. 2 p. l. 261 p. 36 pl. 1870.

Les **Fonds de la Mer.** Paris. GS.*

Petit, P. **8:** 167-198. 1877.

Fremont, Rep. Explor. Exped. 1842-4. Fremont, John Charles. Report of the exploring expedition to the Rocky mountains in the year 1842, and to Oregon and north California in the years 1843-44. 583 p. plates, maps. 1845. [House document no. 166.] LC. Agr.

Bailey, J. W. Diatomaceae. p. 302.

Fricke Verzeich. Fricke, Friedrich. Verzeichniss der in A. Schmidt's Atlas der diatomaceenkunde Tafel 1-204. (Serie i-v.) Abgebildeten und bekannten formen. 69 p. Leipzig, O. R. Reisland, 1902. 30½ cm. Agr.

Girard, Diat. Foss. Girard, J. Études micrographiques. Les diatomées fossiles. 14 p. 4 pl. Paris, E. Martinet, 1867. 24 cm. GS.

Gough, Lewis H. Report on the plankton of the English channel in 1903. **Rep. No. Sea Fish. Comm. 2:** 325-377. charts 1-16. f. 1-7. 1905.

Gran, Norske Nordh. Exped. Gran, Haaken Hasberg. Protophyta: Diatomaceae, Silicoflagellata og Cilioflagellata. (Den Norske Nordhausexpedition 1876-1878. XXIV. Botanik.) 2 p. l. 36 p. 4 pl. Christiana, Grøndahl & Sons Bogtrykker, 1897. 37½ cm. NM.

Text in both Norwegian and English.

Gran. in Röm. & Schaud. Faun. Arct. *See* **Römer,** F., and Schaudinn, F. Fauna arctica.

Gray, John Edward. Handbook of British water-weeds or algae. iv, 123 p. London, R. Hardwicke, 1864. 18½ cm. SC.

The Diatomaceae by W[illiam] Carruthers. p. 75-116.

Gray, Samuel Frederick. A natural arrangement of British plants according to their relations to each other as pointed out by Jussieu, De Candolle, Brown, &c., including those cultivated for use; with an introduction to botany, in which the terms newly-introduced are explained; illustrated by figures. 2 v. xxviii, 824 p. 21 col. pl. incl. front. viii, 757 p. London, Printed for Baldwin, Cradock and Joy, 1821. 22 cm. Agr.

Diatomaceae. v. 1. p. 293-295.

Greg. Gregory, William. Notice of a diatomaceous earth found in the Isle of Mull. **Trans. Micr. Soc. Lond. N. S. 1:** 92-99. f. 1-2. 1853.

Greg. Gregory, William. Notice of the new forms and varieties of known forms occurring in the diatomaceous earth of Mull; with remarks on the classification of the Diatomaceae. **Quart. Journ. Micr. Sci. 2:** 90-100. pl. 4. 1854.

Greg. Gregory, William. Observations on some deposits of fossil Diatomaceae. **Trans. Micr. Soc. Lond. N. S. 2:** 104-106. 1854.

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[a] The author's initials are erroneously given in this article as F. L.

Greg. GREGORY, WILLIAM. On a remarkable group of diatomaceous forms, with remarks on shape or outline as a specific character in the Diatomaceae. **Trans. Micr. Soc. Lond. N. S. 3:** 10–15. pl. 2. 1855. AGR.

Greg. GREGORY, WILLIAM. On a post-tertiary lacustrine sand, containing diatomaceous exuviae, from Glenshira near Inverary. **Quart. Journ. Micr. Sci. 3:** 30–43. pl. 4. 1855. AGR.

Greg. GREGORY, WILLIAM. Notices of some new species of British fresh-wate Diatomaceae. **Quart. Journ. Micr. Sci. 4:** 1–14. 1856. AGR.

Greg. GREGORY, WILLIAM. On the post-tertiary diatomaceous sand of Glenshira. Part II. Containing an account of a number of additional undescribed species. **Trans. Micr. Soc. Lond. N. S. 4:** 35–48. pl. 5. 1856. **5:** 67–88. pl. 1. 1857.

Greg. GREGORY, WILLIAM. On new forms of marine Diatomaceae, found in the Firth of Clyde and in Loch Fine. **Trans. Roy. Soc. Edinb. 21:** 473–542. pl. 9–14. 1857. AGR.

Grev. Scott. Crypt. Fl. GREVILLE, ROBERT KAYE. Scottish cryptogamic flora, or coloured figures and descriptions of cryptogamic plants, belonging chiefly to the order Fungi; and intended to serve as a continuation of English Botany. 6 v. 360 pls. with descriptive text. Edinburgh: printed for Machlachlan & Stewart, Edinburgh; and Baldwin, Cradock & Joy, London, 1823–28. AGR.

Diatomaceae, pls. 16, 35, 244, 287, 289, 291, 295, 297, 298, 354 & 358.

Grev. GREVILLE, ROBERT KAYE. Report on a collection of Diatomaceae made in the district of Braemar by Prof. Balfour and Mr. George Lawson. **Ann. Mag. Nat. Hist.** II. **15:** 252–261. pl. 9. 1855.

Grev. GREVILLE, ROBERT KAYE. Description of some new diatomaceous forms from the West Indies. **Quart. Journ. Micr. Sci. 5:** 7–12. pl. 3. 1857.

Grev. GREVILLE, ROBERT KAYE. Descriptions of some new species and varieties of Naviculae &c., observed in California guano. **Edinb. New Phil. Journ. N. S. 10:** 25–30. pl. 4. 1859.

Grev. GREVILLE, ROBERT KAYE. Descriptions of new species of Diatomaceae, chiefly observed by the late Professor Gregory. **Quart. Journ. Micr. Sci. 7:** 79–86. pl. 6. 1859.

Grev. GREVILLE, ROBERT KAYE. Descriptions of Diatomaceae observed in California guano. **Quart. Journ. Micr. Sci. 7:** 155–166. pl. 7–8. 1859.

Grev. GREVILLE, ROBERT KAYE. On Plagiogramma, a new genus of Diatomaceae. **Quart. Journ. Micr. Sci. 7:** 207–211. pl. 10. 1859.

Grev. GREVILLE, ROBERT KAYE. On Campylodiscus &c. **Trans. Micr. Soc. Lond. N. S. 8:** 29–32. pl. 1. 1860.

Grev. GREVILLE, ROBERT KAYE. A monograph of the genus Asterolampra, including Asteromphalus and Spatangidium. **Trans. Micr. Soc. Lond. N. S. 8:** 102–124. pl. 3–4. 1860.

Grev. GREVILLE, ROBERT KAYE. Descriptions of new and rare Diatoms.

Series I–IV. **Trans. Micr. Soc. Lond. N. S. 9:** 39–45; 67–87. pl. 4 & 8–10. 1861.

Series V–VI. **Trans. Micr. Soc. Lond. N. S. 10:** 18–29; 89–96. pl. 2–3 & 9. 1862.

Series VII. **Quart. Journ. Micr. Sci. N. S. 2:** 231–236. pl. 10. 1862.

Series VIII–IX. **Trans. Micr. Soc. Lond. N. S. 11:** 13–21; 63–76. pl. 1 & 4–5. 1863.

Series X. **Quart. Journ. Micr. Sci. N. S. 3:** 227–237. pl. 9–10. 1863.

Series XI–XIII. **Trans. Micr. Soc. Lond. N. S. 12:** 8–14; 81–94. pl. 1–2 & 10–13. 1864.

Series XIV–XVII. **Trans. Micr. Soc. Lond. N. S. 13:** 1–10; 24–34; 43–75; 97–105. pl. 1–6 & 8–9. 1865.

Series XVII–XX. **Trans. Micr. Soc. Lond. N. S. 14:** 1–9; 77–86; 121–130. pl. 1, 2, 8, 9, 11 & 12. 1866.

Grev. Greville, Robert Kaye. On the Asterolamprae of the Barbadoes deposit. **Trans. Micr. Soc. Lond. N. S. 10:** 41–55. pl. 7–8. 1862.

Grev. Greville, Robert Kaye. A monograph of the genus Auliscus. **Trans. Micr. Soc. Lond. N. S. 11:** 36–53. pl. 2–3. 1863.

Grev. Greville, Robert Kaye. Descriptions of new genera and species of diatoms from the south Pacific. **Edinb. New Phil. Journ. N. S. 18:** 34–43; 181–187. pl. 1, 4. 1863.

Grev. Greville, Robert Kaye. Descriptions of new genera and species of diatoms from Hongkong. **Ann. Mag. Nat. Hist.** III. **16:** 1–7. pl. 5. 1865.

Grev. Greville, Robert Kaye. Descriptions of new species of diatoms from the south Pacific. **Trans. Bot. Soc. Edinb. 8:** 233–238. pl. 3. 1866.

Grev. Greville, Robert Kaye. Descriptions of new and rare diatoms from the tropics and southern hemisphere. **Trans. Bot. Soc. Edinb. 8:** 436–441. pl. 6. 1866.

Griff. & Henf. Micr. Dict. Griffiths, John William and Henfrey, Arthur. The micrographic dictionary; a guide to the examination and investigation of the structure and nature of microscopic objects. Ed. 3. by J. W. Griffiths and Martin Duncan, assisted by Rev. M. J. Berkeley and T. Rupert Jones. v. 1. xli, 845 p. front. 812 f. v. 2. 1 p. l. 48 pl. with explanatory text. London: John van Voorst. 1875. 21½ cm. Agr.

Diatomaceae, p. 235–247. pl. 11–14, 19, 41–43.

Also ed. 4. 1883. Mann.

Gr. & St. Grove, Edmund and Sturt, Gerald. On a fossil marine diatomaceous deposit from Oamaru, Otago, New Zealand. **Jour. Quek. Micr. Club,** II. **2:** 321–330. pl. 18–19. 1886. **3:** 7–12; 63–78; 131–148. pl. 2–3; 5–6; 10–14. 1887. Agr*

Grun. in Schneider, Beitr. Kennt. Kauk. *See* **Schneider,** Oscar.

Grun. Grunow, Albert. Ueber neue oder ungenügend bekannte algen. Erste folge. Diatomaceen, familie naviculaceen. **Verh. Zool.-Bot. Ges. Wien. 10:** 503–582. pl. 3–7. 1860.

Grun. Grunow, Albert. Die österreichischen diatomaceen nebst anschluss einiger neuen arten von andern lokalitäten und einer kritischen uebersicht der bisher bekannten gattungen und arten. **Verh. Zool.-Bot. Ges. Wien, 12:** 315–472; 545–585. pl. 3–7, 13. 1862.

Grun. Grunow, Albert. Ueber einige neue und ungenügend bekannte arten und gattungen von diatomaceen. **Verh. Zool.-Bot. Ges. Wien, 13:** 137–162. pl. 4–5. 1863.

Grun. Grunow, Albert. Beiträge zur kenntniss der Schizonema- und Berkeleya arten. **Hedwigia, 7:** 1–7. 1868.

Grun. Grunow, Albert. Diatomaceae in Fenzl, Eduard. **Reise Novara Bot. 1:** 1–28. pl. 1–1A. 1870. SC.

Grun. Grunow, Albert. New diatoms from Honduras. **Mo. Micr. Journ. 18:** 165–186. pl. 93–96. 1877.

Grun. Grunow, Albert. Some remarks concerning P. T. Cleve and Möller's diatoms. Upsala, 1877. no. 1–48. **Am. Journ. Micr. 3:** 101–105. 1878.

Grun. Grunow, Albert. New species and varieties of Diatomaceae from the Caspian sea. **Journ. Roy. Micr. Soc. 2:** 677–691. pl. 21. 1879.

Grun. Grunow, Albert. On some new species of Nitzschia. **Journ. Roy. Micr. Soc. 3:** 394–397. pl. 12–13. 1880.

Grun. Grunow, Albert. Beiträge zur kenntniss der fossilen diatomeen Österreich Ungarns. **Mojs. & Neum. Beitr. Paläont. Öst.-Ung. 2:** 136–159. pl. 29–30. 1882.

Grun. GRUNOW, ALBERT. Die diatomeen von Franz Josefs-land. **Denkschr. Akad. Wien, 48**^{2}**:** 53-112. pl. 1-5. 1884.

Hab. Cat. HABIRSHAW, F. Catalogue of the Diatomaceae with references to the various published descriptions and figures. Reproduced by the Edison electric pen process. 272 p. New York, 1877. AGR.

Ed. 2 by R. Hitchcock. — p. New York, 1881-2. 1 pt. only pub.
Ed. 3 by Harvey H. Chase. 343 [10] p. Geneva, N. Y. 1885.
Ed. 4 by Harvey H. Chase. 351 p. Linden, Mich. 1887 26 cm.
Ed. 5. Index of Diatomaceae by H. H. Chase. 501 p. 1894.
AGR. copy of ed. 4 has many penciled additions.
Dr. Mann's copy of ed. 3 has been kept up to date.

Hanst. Bot. Abhand. HANSTEIN, JOHANNES. Botanische Abhandlungen aus dem gebiet der morphologie und physiologie. AGR.

Diatomaceae by E. Pfitzer v. **3**. vi, 189 p. 6 pl. 1871

Harv. & Bail. HARVEY, WILLIAM HENRY, AND BAILEY, JACOB WHITMAN. New species of Diatomaceae, collected by the United States Exploring Expedition under the command of Capt. Wilkes, U. S. N. **Proc. Acad. Phila. 6:** 430-431. 1854.

Reprinted in **Quart. Journ. Micr. Sci. 3:** 93-94. 1855.

Hass. Hist. Brit. Alg. HASSALL, ARTHUR HILL. A history of the British freshwater algae, including descriptions of the Desmideae and Diatomaceae with upwards of one hundred plates illustrating the various species. v. 1. viii, 462 p. 1 l. v. 2. 24 p. 103 col. pl. London: S. Highley, [etc. etc.] 1845. 22 cm. LC.

Diatomaceae. v. 1. p. 395-439. v. 2. p. 21-24. pl. 93-102. .

Hedwigia. AGR.

Bleisch, (Max?). **2:** 19-20: 28-33. 1860.
Grunow, A. **7:** 1-7. 1868.
Wigand, A. **2:** 41-46. 1860.

Heib. Krit. Overs. Danske Diat. HEIBERG, PEDER ANDREAS CHRISTIAN. Kritisk oversigt over de Danske diatomeer. Forste hefte: trykt som afhandling for den philosophiske doktorgrad. 1 p. l. 78 p. 6 pl. Kjøbenhavn, William Priors. 1863. 26 cm. SC.

Reviewed with extracts in **Quart. Journ. Micr. Sci. N. S. 4:** 198-200. 1864. Title given as Conspectus criticus diatomacearum Danicarum.

Hendry, WILLIAM. On the Hull Pleurosigma fasciola. **Quart. Journ. Micr. Sci. N. S. 2:** 152-155. 2 f. 1862.

Herib. Diat. Auverg. HERIBAUD, JOSEPH. Les diatomées d'Auvergne. 1 p. l. 255 p. 6 pl. Paris, Paul Klincksieck. 1893. 27 cm. · AGR.

Herib. Diat. Foss. Auverg. HERIBAUD, JOSEPH. Les diatomées fossiles d'Auvergne. 2 pts. text. pls. Paris, Clermont-Ferrand [et] Paul Klincksieck. 1902-1903. 27½ cm. GS.

pt. 1. 79 p. pl. 7-8. 1902.
pt. 2. x, 166 p. pl. 9-12. 1903.

Heurck, HENRI VAN. Synopsis des diatomées de Belgique. 2 v. text and atlas. Anvers. Édité par l'auteur. 1880-1885. 26½ cm.

Text, 4 p. l. 235 p. 3 l. 3 pl. Table alphabetique, 120 p. 1885.
Atlas, 3 p. l. 132 pl. with descr. leaf, and index of 3 l. 1880-1881.

Heurck, HENRI VAN. Types du Synopsis des diatomées de Belgique. Serie I-XXII. Exsiccata. Anvers, 1884-

Series V-XXII reviewed in Bot. Centralbl. **33:** 323-325. 1888.

Heurck, HENRI VAN. A treatise on the Diatomaceae containing introductory remarks on the structure, life history, collection, cultivation and preparation of diatoms, and a description and figure typical of every known genus, as well as a description and figure of every species found in the North Sea and countries bordering it, including Great Britain, Belgium, &c. xx, 558 p. front. 35 pl. 291 text fig. London; William Wesley & Son, 1896. 28½ cm. FISH.

H. L. Smith. *See* **Smith,** H. L.

Hook. in Sm. Eng. Fl. *See* **Smith,** J. E.

Jahresb. Komm. Deut. Meere. Jahresbericht der kommission zur wissenschaftlichen untersuchung der deutschen meere in Kiel. GS.
Schmidt, A. 2: 81–96. 1875. ●

Jan. Diat. Gaz. Exped. JANISCH, C. The diatoms of the Gazelle Expedition. 22 pl. photographs, with manuscript index. MANN.
Not published but distributed to several diatomists by the author.
This set lacks the index and plates 7, 8, 10, 12, 13, 14, 17 and 18.

Jan. JANISCH, C. Zur charakteristik des guano's von verschiedenen fundorten. **Abh. Schles. Ges. Vaterl. Cult.** **1861**^{3}: 150–164. pl. 1–2. 1861. **1862**^{2}: 1–29. pl. 1A–2B. 1862.

Jan. & Rabh. in Rabh. Beitr. *See* **Rabenhorst,** LUDWIG.

J. E. Smith. *See* **Smith,** J. E.

Johnson, ALEXANDER S. Notice of some undescribed infusorial shells. **Am. Journ. Sci.** II. **13**: 33. 1852.

Johnst. JOHNSTON, CHRISTOPHER. Descriptions of Diatomaceae, chiefly of those found in "Elide" (Lower California) Guano. **Quart. Journ. Micr. Sci. 8**: 11–21. pl. 1. 1860.

Jorg. in Nordg. Hydrog. & Biol. Inv. *See* **Nordgaard,** O.

Journ. Linn. Soc. Bot. The Journal of the Linnean Society. Botany. AGR.
Kitton, F. 20: 513–515. 1884.
O'Meara, E. 15: 55–59 1876.

Journ. Mus. Godef. Journal des Museum Godeffroy. Geographische, ethnographische und naturwissenschaftliche mittheilungen. SC.
Witt, O. N. 1: 63–70. 1873.

Journ. Quek. Micr. Club. The Journal of the Quekett Microscopical Club. SURG.
Brébisson, A. de. 2; 37–43. 1870.
Cleve, P. T. II. 2: 165–177. 1885.
Grove, E. & Sturt, G. II. 2: 231–330. 1886 3: 7–12; 63–78; 131–148. 1886–87.
Kitton, F. 2: 99–102: 168–171. 1871. II. 1: 166–172 1883.
Morland, H. II. 3: 79–80; 167–168. 1887.
Rattray, J. II. 4: 137–212. 1890.

Journ. Roy. Micr. Soc. Journal of the Royal Microscopical Society; containing the transactions and proceedings and a record of current researches relating to invertebrata, cryptogamia, microscopy, &c. AGR.
Grunow, A. 2: 677–691. 1879. 3^{1}: 394–397. 1880.
Mills, L. G. II. 1: 865–867. 1881.
Petit, P. 1: 237–245. 1878.
Rattray, J. II. 8^{1}: 337–382. 1888. II. 8^{2}: 861–920. 1888.
Shrubsole, W. H., & Kitton, F. II. 1: 381–387. 1881.
Stolterfoth, H. 2: 835–836. 1879.

Kain, C. HENRY. Notes on diatoms. **Bull. Torr. Club, 14**: 25–32; 141. 1887.

Kain, C. HENRY. *See also* **Schmidt,** ADOLF.

Kain, C. HENRY, AND **Schultze,** EDWIN A. On a fossil marine diatomaceous deposit, from Atlantic City, N. J. **Bull. Torr. Club. 16**: 71–76; 207–210. pl. 89, 92, 93, 1889.

Kain, C. HENRY, AND **Schultze,** EDWIN A. The Santa Monica diatomaceous deposit with list of referenecs to figures of species. **Bull. Torr. Club, 24**: 496–504. 1897.

Kitton, FREDERIC. A bibliography of the microscope and micrographic studies, being a catalogue of books and papers in the library of Julien Deby. Part III. The Diatomaceae. *See* **Deby, J.**

Kitt. Kitton, Frederic. Description of a new genus of Diatomaceae, and observations on the costae of Pinnularia peregrina. **Quart. Journ. Micr. Sci. N. S. 8:** 16–17. 1868.

Kitt. Kitton, Frederic. Diatomaceous deposits from Jutland. **Journ. Quek. Micr. Club, 2:** 99–102. pl. 1–3. 1870; 168–171. pl. 13–14. 1871.

Kitt. Kitton, Frederic. Remarks on Aulacodiscus formosus, Omphalopelta versicolor, &c., with description of a new species of Navicula. **Mo. Micr. Journ. 10:** 6–9. pl. 21. 1873.

Kitt. Kitton, Frederic. New Diatoms. **Mo. Micr. Journ. 12:** 218–220. pl. 81–82. 1874.

Kitt. Kitton, Frederic. Hyalodiscus subtilis and H. californicus. With notes by H. L. Smith. **Am. Journ. Micr. 3:** 247–250. f. 1–8. 1878.

Kitt. Kitton, Frederic. Notes on diatomacearum Dillwynii, or the genera and species of Diatomaceae in "The British Confervae" of Dillwyn. **Journ. Quek. Micr. Club:** II. **1:** 166–172. pl. 6. 1883.

Kitt. Kitton, Frederic. On some Diatomaceae from the island of Socotra. **Journ. Linn. Soc. Bot. 20:** 513–515. pl. 48. 1884.

Kütz. Kützing, Friedrich Traugott. Synopsis diatomaceearum, oder versuch einer systematischen zusammenstellung der diatomeen. **Linnaea, 8:** 529–620. pl. 13–19. 1833.

Kütz. *Bacill.* Kützing, Friedrich Traugott. Die kieselschaligen bacillarien oder diatomeen. 3 p. l. 152 p. 29 pl. Nordhausen, W. Köhne, 1844. 28½ cm. LC.

Kütz. Sp. Alg. Kützing, Friedrich Traugott. Species Algarum. vi, 922 p. Lipsiae, F. A. Brockhaus, 1849. 21½ cm. Agr.

Lagers. Lagerstedt, Nils Gerhard Wilhelm. Sötvattens diatomaceer från Spetsbergen. **Bih. Sv. Vet.-Akad. Handl.** 1^{14}: 1–52. pl. 1–2. 1873.

Lagers. Lagerstedt, Nils Gerhard Wilhelm. Saltvattens-diatomaceer från Bohuslän. **Bih. Sv. Vet.-Akad. Handl.** 3^{15}: 1–66. pl. 1. 1876.

Lagers. Lagerstedt, Nils Gerhard Wilhelm. Diatomaceerna i Kützings exsikatverk: Algarum aquae dulcis germanicarum decades. **Öfv. Kgl. Vet.-Akad.** $41^{2\ 3}$: 29–64. pl. 8. 1884.

Lanzi, Matteo. Le diatomee rinvenute nel lago Trajano, nello stagno di maccarese eloro adiacenze. **Atti Soc. Critt. Ital.** II. **3:** 122–129. 1883.

Lanzi, Matteo. Le diatomee fossili del Quirinale. **Atti Accad. Lincei, 47:** [1–7]. 1894. GS.*

Laud. Lauder, Henry Scott. On new diatoms. **Trans. Micr. Soc. Lond. N. S. 12:** 6–8. pl. 3. 1864.

Laud. Lauder, Henry Scott. Remarks on the marine Diatomaceae found at Hong Kong, with descriptions of new species. **Trans. Micr. Soc. Lond. N. S. 12:** 75–79. pl. 8. 1864.

Le Diatomiste. *See under* **Diatomiste.**

The **Lens:** a quarterly journal of microscopy and the allied natural sciences, with the Transactions of the State Microscopical Society of Illinois. Edited by S. A. Briggs, E. H. Sargent, Charles Adams, O. S. Westcott, publishing committee. 2 v. pls. Chicago, The State Microscopical Society of Illinois, 1872. 23½ cm. (all published). Agr.

Smith, H. L. **1:** 1–19; 72–93; 154–157. **2:** 65–91. 1873.

Leud.-Fort. Leuduger-Fortmorel, G. Catalogue des diatomées de l'île Ceylan. **Mém. Soc. Emul. St. Brieuc,** 1–73. pl. 1–9. 1879. GS.*

Leud.-Fort. Leuduger-Fortmorel, G. Diatomées de la Malaise. **Ann. Jard. Bot. Buitenz. 11:** 1–60. pl. 1–7. 1892. GS*.

Lewis, FRANCIS W. Notes on new and rarer species of Diatomaceae of the United States sea board. **Proc. Acad. Phila. 1861:** 61-71. pl. 1–2. 1862.
Republished without the plates in **Quart. Journ. Micr. Sci. N. S. 2:** 155-161. 1862.

Lewis, FRANCIS W. On some new and singular intermediate forms of Diatomaceae. **Proc. Acad. Phila. 1863:** 336–346. pl. 1864.

Lewis, FRANCIS W. On extreme and exceptional variations of diatoms in some White mountain localities, &c. **Proc. Acad. Phila. 1865:** 7–18. pl. 1–2. 1865.

Linnaea. Ein journal für die botanik in ihrem ganzen umfange. NM. AGR.
Kützing, F. T. **8:** 529–620. 1833.

L. W. Bail. *See* **Bailey**, L. W.

Lyng. Hydro. Dan. LYNGBYE, HANS CHRISTIAN. Tentamen hydrophytologiae danicae, continens omnia hydrophyta cryptogama Daniae, Holsatiae, Faeroae, Islandiae, Groenlandiae hucusque cognita, systematice disposita, descripta et iconibus illustrata, adjectis simul speciebus norvegicis. 1 p. l. xxxii, 248 p. 70 col. pl. Hafniae, Typis Schultzianis. 1819. 26 cm. LC.

Mann, ALBERT. List of Diatomaceae from a deep sea dredging in the Atlantic ocean off Delaware bay by the U. S. Fish commission steamer Albatross. **Proc. U. S. Nat. Mus. 16:** 303–312. 1894.

Math. Termész. Közlem. Mathematikai és Természettudományi Közlemenyek. Vonatkozolag a hazai viszonyokra. Kiadja a Magyar Tudományos Ákadémia Mathematikai és Természettudományi Állandó bizottsága. AGR.
Neupauer, J. **5:** 183–206. 1867.

Meddel. Komm. Havund. Ser. Plankt. Meddelelser fra Kommissionen for Havundersogelser. Serie: Plankton. NM. AGR.
Paulsen, O. 1^{3}: 1–7. 1905.

Mél. Biol. Acad. Sci. St. Pétersb. Mélanges Biologiques tirés du Bulletin de l'Académie Impériale des Sciences de St. Pétersbourg. NM.
Weisse, J. F. **1:** 875–211. 1851. **2:** 237–250. 1855. **3:** 357–362. 1860. **4:** 659–664. 1865. **5:** 105–108. 1865. **6:** 303–311. 1867.

Mem. Accad. Lincei. Memorie dell' Accademie Pontificia de' Nuovi Lincei. Rome. GS.*
Antonelli, G., et Bonetti, F. **9:** 1–14. 1893.

Mém. Mus. Paris. Mémoires du Muséum d'Histoire Naturelle, Paris. SC.
Turpin, P. J. F. **16:** 361–368. 1828.

Mém. Soc. Acad. Fal. Mémoires de la Société Académique des Sciences, Arts et Belles-lettres de Falaise. 1. v. **1835^{6}:** 1836.
Brébisson, A. de, et Godey. p. 1–63; 256–269.

Mém. Soc. Emul. St. Brieuc. Mémoires de la Société d'Emulation des Côtes-du-Nord. St. Brieuc. GS.*
Leuduger-Fortmorel, G. 1–73. pl. 1–9. 1879.

Mém. Soc. Phys. et Hist. Nat. Genève. Mémoires de la Société de Physique et d'Histoire Naturelle de Genève. NM. AGR.
Brun, J. **31^{1}:** 1–47. 1891.
Brun, J. & Tempère, J. **30^{9}:** 1–75. 1889.

Mém. Soc. Sci. Nat. Cherb. Mémoires de la Société des Sciences Naturelles de Cherbourg. LC.
Brébisson, A. **2:** 241–258. 1854.

Mills, LEWIS G. Diatoms from Peruvian guano. **Journ. Roy. Micr. Soc.** II. **1:** 865–867. pl. 11. 1881.

Moeb. Diat.-taf. MOEBIUS, B. Diatomeen-tafeln zusammengestellt für einige freunde. Als manuskript gedruckt. 32 p. 81 pl. [New York, 1890.] 24½ cm. AGR.
Moebius's plates of diatoms. Index. [n. p., n. d.] 17 l. 22 cm.

Mo. Micr. Journ. The monthly microscopical journal: transactions of the Royal Microscopical Society, and record of histological research at home and abroad.

Grunow, A. **18:** 165–186. 1877.
Kitton, F. **10:** 6–9. 1873. **12:** 218–220. 1874.

Monatsb. Akad. Wiss. Berlin. Monatsberichte der Königlichen Preuss. Akademie der Wissenschaften zu Berlin. AGR.

Ehrenberg, C. G. **1856:** 323–339.

Mont. in Sagra Hist. Cuba. *See* **Sagra,** RAMON DE LA.

Morland, HENRY. On the structure of Aulacodiscus margaritaceus Ralfs. **Journ. Quek. Micr. Club,** II. **3:** 79–80. 1887.

Morland, HENRY. Do Porodiscus interruptus and Craspedoporus elegans belong both to one form? **Journ. Quek. Micr. Club,** II. **3:** 167–168. 1887.

Mojs. & Neum. Beitr. Paläont. Öst.-Ung. MOJSISOVICS, E. V. UND NEUMAYR, R. Beiträge zur Paläontologie Österreich-Ungarns und des Orients. v. 2. 2 p. l. 162 p. 30 pl. Wien. Alfred Hölder. 1882. LC. GS.

Diatomaceae by A. Grunow. p. 136–159.

Murray, GEORGE. On the reproduction of some marine diatoms. **Proc. Roy. Soc. Edinb. 21:** 207–219. pl. 1–3. 1897.

Neue Schrift. Naturf. Ges. Halle. Neue schriften der Naturforschende Gesellschaft. Halle.

Nitzsch, C. L. **3:** (—). 1817.

Neup. NEUPAUER, JÁNOS-TÓL. Az ásatag diatomaceák (oszlókafilék). Rhyolith csiszpalában s egyéb közetekben. **Math. Termesz. Közlem. 5:** 183–206. pl. 1–3. 1867.

Nitzsch, CHRISTIAN LUDWIG. Beiträge zur infusorienkunde oder naturbeschreibung der zerkarien und bazillarien. **Neue Schrift. Naturf. Ges. Halle, 3:** ( ) 1817. SURG.

cf. Isis, oder encyclopädische zeitung von Oken. 726–728 [677–679]. 1818.

Noetl. NOETLING, FRITZ. Ueber diatomaceenführende schichten des westpreussischen diluviums. **Zeitsch. Deut. Geol. Gesell. 35:** 318–354. 1883.

Nordenskiöld, ADOLF ERIK. Vega-expeditionens vetenskapliga iakttagelser bearbetade af deltagare i resan och andra forskare. v. **3.** 2 p. l., 529, 2 p. 44 pl. Stockholm, F. & G. Beijers förlag, 1883. 25 cm. AGR.* SC.

Diatoms collected during the expedition of the Vega examined by P[ehr] T[heodor Cleve]. p. 455–517. pl. 35–38.

Nordgaard, O. Bergens museum. Hydrographical and biological investigations in Norwegian fiords. The protist plankton and the diatoms in bottom samples by E[ugen] Jørgensen. 4 p. l. 254 p. 21 pl. Bergen, John Grieg, 1905. 37 cm.

Diatomaceae, p. 50, 54, 57, 60, 63, 66, 69, 73, 76, 79, 83, 90–108, 146–151, 195–225. pl. 6–7.

Norm. NORMAN, GEORGE. Notes on some new and rare Diatomaceae from the stomachs of Ascidiae. **Ann. Mag. Nat. Hist.** II. **20:** 158–159. 1857.

Norm. NORMAN, GEORGE. List of Diatomaceae occurring in the neighborhood of Hull. **Trans. Micr. Soc. Lond. N. S. 8:** 59–71. 1860.

Norm. NORMAN, GEORGE. On some undescribed species of Diatomaceae. **Trans. Micr. Loc. Lond. N. S. 9:** 5–9. pl. 2. 1861.

LA **Notarisia.** Commentarium phycologicum. Redattori G. B. de Toni e David Levi-Morenos.

Toni, G. B. de. **2:** 351. 1887. **3:** 608, 626. 1888.

Nyl. NYLANDER, WILLIAM. Diatomaceis Fenniae fossilibus additamentum. **Sällsk. Faun. Fl. Fenn. Förh. 6:** 145–159. 1861.

Öfv. Kgl. Vet.-Akad. Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar. Agr.

Cleve, P. T. **24**: 661–669; **25**: 213–239. 1868. **38**^{10}: 3–13. 1882.
Lagerstedt, N. G. W. **41**$^{1-3}$: 29–64. 1884.

Okeden, Fitzmaurice. On the deep diatomaceous deposits of the mud of Milford Haven and other localities. **Quart. Journ. Micr. Sci. 3**: 26–30. 1855.

O'Meara, Eugene. On some new and rare Diatomaceae from the west coast of Ireland. **Quart. Journ. Micr. Sci. N. S. 7**: 113–118. pl. 5. 1867.

O'Meara, Eugene. On new forms of Diatomaceae, from dredgings off the Arran Islands, Co. Galway. **Quart. Journ. Micr. Sci. N. S. 7**: 245–247. pl. 7. 1867. **9**: 150–151. pl. 12. 1869.

O'Meara, Eugene. On some peculiar forms of Navicula from the Sulu archipelago. **Journ. Roy. Micr. Soc. N. S. 12**: 283–287. pl. 13. 1872.

O'Meara, Eugene. On Diatomaceae from Spitzbergen. **Quart. Journ. Micr. Sci. N. S. 14**: 254–261. pl. 8. 1874.

O'Meara, Eugene. Report on the Irish Diatomaceae. Part I. **Proc. Roy. Irish Acad.** II. **2**: 235–425. pl. 26–35. 1875.

All published.

O'Meara, Eugene. On the diatomaceous gatherings made at Kerguelen's Land by H. N. Moseley, M. A., H. M. S. Challenger. **Journ. Linn. Soc. Bot. 15**: 55–59. pl. 1. 1876.

Palmer, Thomas Chalkley and **Keeley,** Frank J. The structure of the diatom girdle. **Proc. Acad. Phila. 1900**: 465–479. pl. 15–16. 1900.

Pant. Beitr. Bacill. Ung. Pantocsek, Josef. Beiträge zur kenntniss der fossilen bacillarien Ungarns. 3 teile. texts, pls. Nagy-Tapolosány, Julius Platzko. 1886–1893. GS. [pt. III missing.]

I. teil. Marine bacillarien. 75 p. 30 pl. 1886.

II. teil. Brackwasser-bacillarien. Anghan: Analyse der marinen depôts von Bory, Bremia, Nagy-Kürtös in Ungarn; Ananino und Kusnetzk in Russland. 123 p. 30 pl. 1889. [S.]

III. teil. Süsswasser-bacillarien. Anhang- Analysen 15 neuer depôts von Bulgarien, Japan, Mähren, Russland und Ungarn. 1 l. 42 pl. 1893. [Ap.]

2. verbesserte auflage. 3. teile in 1 heft. Berlin, W. Junk. 1903. 28 cm. I. teil. 77 p. 30 pl. II. teil. 123 p. 30 pl. III. teil. 1 l. 42 pl. GS.

Pauls. Paulsen, Ove. On some Peridineae and plankton-diatoms. **Meddel. Komm. Havund. Ser. Plankton. 1**^{3}: 1–7. f. 10. 1905.

Perag. Peragallo, H. Diatomées du midi de la France. **Bull. Soc. Hist. Nat. Toulouse, 18**: 189–272. 1884. Agr.*

Reprinted p. 1–88. 1884.

Perag. Peragallo, H. Diatomées de la baie de Villefranche. **Bull. Soc. Hist. Nat. Toulouse, 22**: 13–100. pl. 1–6. 1888. Agr.*

Reprinted as "Diatomées du midi de la France" with a subtitle as above. p. 1–92. 1888.

Perag. Peragallo, H. Monographie du genre Pleurosigma et des genres alliés. **Le Diatomiste, 1**^{4}: 1–16. pl. 1–5. 1891. **1**^{5}: 17–35. pl. 6–10. [Index 2 l.] 1891.

Perag. Peragallo, H. Monographie du genre Rhizosolenia et de quelques genres voisins. **Le Diatomiste, 1**: 79–82; 99–117. pl. 13–15 & 17–18. 1892.

Petit, Paul. Catalogue des diatomées de l'île Campbell et de la nouvelle-Zelande. **Fonds de la Mer, 3**: 167–198. pl. 4–5. 1877. GS.*

Translated by F. Kitton and republished in Journ. Roy. Micr. Soc. 1: 237–275. pl. 14–15. 1878.

Petit, Paul. Essai d'une classification des diatomées. **Bul. Soc. Bot. Fr. 23:** 372–383. pl. 4. 1876.

Translation by F. Kitton in Mo. Micr. Journ. **18:** 10–14; 65–75. pl. 187. 1877.

Petit, Miss. Sci. Cap Horn. Petit, Paul. Mission Scientifique du Cap Horn. 1882–1883. v. 5. Botanique par P. Hariot, P. Petit, J. Muller d'Argovie, E. Bescherelle, C. Massalongo, et a. Franchet. 2 p. l. 400 p. 33 pl. 3 maps. Paris, Gauthier-Villars et Fils. 1889. 27½ cm.

Pfitz. Pfitzer, Ernst. Untersuchungen über bau und entwicklung der bacillariaceen. (Diatomaceen.) **Hanst. Bot. Abhandl. 2:** i–vi, 1–189 p. pl. 1–6. 1871.

Phys. Abh. Akad. Wiss. Berlin. Physikalische Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin.
1831–49 SM.
1851–date Agr.
1862–75 LC.

Ehrenberg, C. G. **1831:** 1–154. 1832. **1836:** 109–135. 1838. **1838:** 59–147. 1840. **1839:** 81–174. 1841. **1841:** 291–446. 1843. **1847:** 269–460. 1849. **1862:** 39–74. 1863. **1869:** 1–66. 1870. **1870:** 1–74. 1871. **1871:** 1–150. 1872. **1872:** 131–398. 1873. **1875:** 1–226. 1876.

Prinz, W. Étude sur des coupes de diatomée observées dans des lames minces de la roche de Nykjobing (Jutland). **Bull. Soc. Belg. Micr. 7:** xlv–lvii. pl. 1. 1881.

Pritch. Hist. Infus. Pritchard, Andrew. A history of infusoria, living and fossil: arranged according to "Die infusionsthierchen" of C. G. Ehrenberg; containing coloured engravings, illustrative of all the genera, and descriptions of all the species in that work, with several new ones; to which is appended an account of those recently discovered in the chalk formations. viii, 439 p. 12 pl. London, Whittaker and Co. 1842. 21½ cm. LC.

Edition 1 reprinted in 1845 and 1849 without change except to leave out p. vii–viii containing the list of original subscribers. 1849 repr. Agr. Surg.

Agr. 1849 copy is called "Second Edition" on the title page but is only a reprint.

Edition 4 revised and enlarged by J. T. Arlidge, W. Archer, J. Ralfs, W. C. Williamson and the author. xii, 968 p. 40 pl. London, Whittaker and Co. 1861. 23 cm. Agr. Surg.

Pritch. Hist. Animalc. Pritchard, Andrew. A history of Infusorial animalcules, living and fossil: illustrated by several hundred magnified representations.

A new edition enlarged. viii, 704 p. 1 l. 24 pl. London, Whittaker and Co. 1852. 21½ cm.
In some copies the plates are colored. Agr. LC.

Proc. Acad. Phila. Proceedings of the Academy of Natural Sciences of Philadelphia.
NM. Agr.

Baily, J. W. **6:** 431–432. 1854.
Boyer, C. S. **1898:** 468–470. 1898. **1900:** 685–748. 1901.
Harvey, W. H., & Bailey, J. W. **6:** 430–431. 1854.
Lewis, F. W. **1861:** 61–71. 1862. **1863:** 336–346. 1864. **1865:** 7–18. 1865.
Palmer, T. C., & Keeley, F. J. **1900:** 465–479. 1900.

Proc. Am. Soc. Micr. Proceedings of the American Society of Microscopists.
LC. Agr.* Surg.

Cox, J. D. **12:** 178–183. 1891.
Smith, H. L. **8:** 30–66. 1886. **9:** 126–167. 1888.

Proc. Roy. Irish Acad. Proceedings of the Royal Irish Academy. Second Series.
Agr.* LC.

O'Meara, E. **2:** 235–425. 1875.

Proc. Roy. Soc. Edinb. Proceedings of the Royal Society of Edinburgh.
Agr. Surg.* Sm.

Murray, G. **21:** 207–219. 1897.
Rattray, J. **16:** 449–692. 1889.*

Proc. U. S. Nat. Mus. Proceedings of the United States National Museum.
NM. Agr.

Mann, A. **16:** 303–312. 1894.

Quart. Journ. Micr. Sci. Quarterly Journal of Microsopical Science.
AGR.* SURG. LC.

Arnott, G. A. Walker-. **3**: 93–94; 307–312. 1855. **6**: 87–93; 159–165; 184; 186; 195–206. 1858. **7**: 254. 1859. **8**: 244–248. 1860.

Brightwell, Thos. **1**: 245–252. 1853. **4**: 105–109; 272–276. 1856. **6**: 93–95; 153–155. 1858. **7**: 179–181. 1859. **8**: 93–96. 1860.

Donkin, A. S. N. S. **1**: 1–15. 1861. N. S. **9**: 287–296. 1869.*

Eulenstein, Th. N. S. **4**: 172–173. 1864. **5**: 65–66. 1865.

Gregory, W. **2**: 90–100. 1854. **3**: 30–43. 1855. **4**: 1–14. 1856.

Greville, R. K. **5**: 7–12. 1857. **7**: 79–86; 155–166; 207–211. 1859. N. S. **2**: 231–236. 1862. N. S. **3**: 227–237. 1863.

Hendry, W. T. N. S. **2**: 152–155. 1862.

Johnston, C. **8**: 11–21. 1860.

Kitton, F. N. S. **8**: 16–17. 1868.

Okeden, F. **3**: 26–30. 1855.

O'Meara, E. N. S. **7**: 113–118; 245–247. 1867. **12**: 283–287. 1872. **14**: 254–261. 1874.

Roper, F. C. S. **2**: 283–284. 1854. **6**: 17–25. 1858. **7**: 261–262. 1859.

Schultze, M. S. **7**: 13–21. 1859. N. S. **3**: 120–134. 1863.

Smith, Wm. **3**: 130–135. 1855.

Wallich, G. C. **6**: 242–253. 1858.

West, T. **6**: 186–188. 1858.

Quek. Treat. Micr. QUEKETT, JOHN. A practical treatise on the microscope. (— p.) London. 8°.

ed. (1?). 1848. Libr. Linn. Soc. Lond. (not seen).

ed. (2?). 1855.

Rabh. Süssw.-Diat. RABENHORST, LUDWIG. Die süsswasser-diatomaceen für freunde der mikroscopie. 72 p. 10 pl. Leipzig, Eduard Kummer, 1853. 31 cm.
AGR.

Rabh. Beitr. RABENHORST, LUDWIG. Beiträge zur näheren kenntniss und verbreitung der Algen. v. 1. (p.), 1863. 4°.

Janisch, C., und Rabenhorst, L. Ueber Meeres-Diatomaceen von Honduras.

Rabh. Krypt. Fl. RABENHORST, LUDWIG. Kryptogamen-flora von Sachsen, der Ober-Lausitz, Thüringen und Nord-Böhmen, mit berücksichtigung der benachbarten länder. 2 v. text, figs. Leipzig, Eduard Kummer. 1863–70. 18½ cm.
GS. AGR.

Diatomaceae. v. 1. p. 1–56. figs. 1863.

Rabh. Fl. Eur. Alg. RABENHORST, LUDWIG. Flora Europaea algarum aquae dulcis et submarinae. Sectio 1–3. figs. Lipsiae, apud Eduardum Kummerum, 1864–1868. 23½ cm.
GS. AGR.

Diatomaceae. Sectio 1. 359 p. figs. 1864.

Ralfs, JOHN. On the Diatomaceae. **Ann. Mag. Nat. Hist. 11**: 447–457. pl. 8–9. 1843. **12**: 104–111; 270–276; 346–352. pl. 2, 8, 9. 1843.

Ralfs, JOHN. On the British species of Meridion and Gomphonema. **Ann. Mag. Nat. Hist. 12**: 457–467. pl. 18. 1843.

Ralfs, JOHN. On the British species of Grammonema and Eunotia. **Ann. Mag. Nat. Hist. 13**: 457–461. pl. 14. 1844.

Ralfs, JOHN. On the British species of Achnanthes. **Ann. Mag. Nat. Hist. 13**: 489–493. pl. 14. 1844.

Ralfs, JOHN. On the British Diatomaceae. **Ann. Mag. Nat. Hist. 16**: 109–112. pl. 3. 1845.

Ratt. RATTRAY, JOHN. A revision of the genus Aulacodiscus Ehrb. **Journ. Roy. Micr. Soc. 8**^{1}: 337–382. pl. 5–7. 1888.

Ratt. RATTRAY, JOHN. A revision of the genus Auliscus Ehrb., and some allied genera. **Journ. Roy. Micr. Soc. 8**^{2}: 861–920. pl. 12–16. 1888.

Ratt. RATTRAY, JOHN. A revision of the genus Coscinodiscus and some allied genera. **Proc. Roy. Soc. Edinb. 16**: 449–692. pl. 16 [3 pts.]. 1889.
AGR.*

Ratt. RATTRAY, JOHN. A revision of the genus Actinocyclus Ehrb. **Journ. Quek. Micr. Club,** II. **4:** 137-212. pl. 11. 1890.

Rec. Geol. Surv. N. S. W. Records of the Geological Survey of New South Wales. (Department of Mines and Agriculture, Sydney.) GS.

Card, G. W., & Dunn, W. S. **5:** 128-148. 1897.

Rept. No. Sea Fish. Comm. North sea fisheries investigation committee. Report (no. 2.—Southern area) on fishery and hydrographical investigations in the North sea and adjacent waters. 1902-1903. ix, 377 p. charts. figs. London, Darling & Son, Ltd., 1905. 37½ cm. LC.

Rept. Sta. Geol. N. J. Annual report of the state geologist. [Geological survey of New Jersey.] GS. AGR.*

Woolman, L. **1891:** 223-232. 1892.

Rept. U. S. Comm. Fish. U. S. Commission of Fish and Fisheries. Report of the commissioner. AGR.

Rev. de Comm. Revue de Comminges, Saint-Gaudens. AGR.*

Belloc, E. **3:** [1-58.] 1887.

Ries, HEINRICH. Microscopic organisms in the clays of New York state. **Trans. N. Y. Acad. Sci. 13:** 165-169. pl. 3-4. 1894.

Romer, FRITZ, UND **Schaudinn,** FRITZ. Fauna arctica. Eine zusammenstellung der arktischen tierformen, mit besonderer berücksichtigung des Spitzbergen-gebietes auf grund der ergebnisse der Deutschen expedition in das nördliche eismeer im jahr 1898. v. 1-4³. pls. figs. Jena, Verlag von Gustav Fischer, 1900-1906. 36 cm. NM.

Die diatomeen der arktischen meere. Von Haaken Hasberg. Gran. **3:** 509-554. pl. 17. 1904.

Roper, FREEMAN CLARK SAMUEL. Three new British species of Diatomaceae. **Quart. Journ. Micr. Sci. 2:** 283-284. f. 1-3. 1854.

Roper, FREEMAN CLARK SAMUEL. Some observations on the Diatomaceae of the Thames. **Trans. Micr. Soc. Lond. N. S. 2:** 67-80. pl. 6. 1854.

Roper, FREEMAN CLARK SAMUEL. Notes on some new species and varieties of British marine Diatomaceae. **Quart. Journ. Micr. Sci. 6:** 17-25. pl. 3. 1858.

Roper, FREEMAN CLARK SAMUEL. On Actinocyclus and Eupodiscus. **Quart. Journ. Micr. Sci. 7:** 261-262. 1859.

Roper, FREEMAN CLARK SAMUEL. On the genus Biddulphia and its affinities. **Trans. Micr. Soc. Lond. N. S. 7:** 1-24. pl. 1-2. f. 1-5. 1859.

Roper, FREEMAN CLARK SAMUEL. On Triceratium arcticum. **Trans. Micr. Soc. Lond. N. S. 8:** 55-58. f. 1. 1860.

Roper, FREEMAN CLARK SAMUEL. On the genus Licmophora (Agardh). **Trans. Micr. Soc. Lond. N. S. 11:** 53-62. f. 1-2. 1863.

Sagra, RAMÓN DE LA. Historia física, política y natural de la isla de Cuba. 13 v. pl. maps. Paris, 1840-1861. 40 cm. AGR.

Diatomaceae by Montagne, Jean François Camille. v. 9. p. 8-9. 1845.

Sällsk. Faun. Fl. Fenn. Forh. Notiser ut sällskapets pro fauna et flora Fennica förhandlingar. AGR.

Nylander, W. **6:** 145-159. 1861.

Schmidt, Atlas. SCHMIDT, ADOLF. Atlas der diatomaceen-kunde, in verbindung mit den Herren Grundler, Grunow, Janisch, Weisflog und Witt, herausgegeben von Adolf Schmidt, archidiaconus in Aschersleben. 36 Heft. 144 pl. [with explanatory leaf]. Aschersleben, Ernst Schlegel, 1875-1882. 40½ cm.

Verzeichniss der in A. Schmidt's Atlas der diatomaceenkunde. Heft 1-36 (Serie I-III) abgebildeten arten und benannten varietäten nebst den mit angeführten synonymen. 2 p. l. 29 p. Leipzig, O. R. Reisland, 1890.

Blueprint copy by C. Henry Kain, Camden, N. J. 1884- ? AGR.

The date of issue is printed on the first page of each heft, except heft 1, which was January, 1874.

Schmidt, Atlas. Zweite revidirte auflage. Serie I–V. Heft 1–66. pl. 1–264 with explanatory leaf]. [Heft 1–36.] Aschersleben, Ludwig Sievers. [Heft 37–66.] Leipzig, O. R. Reisland, 1885–1906. AGR.

Verzeichniss der auf tafel 1–240 (Serie I–V) abgebildeten u. bekannten formen. Herausgeben von F. Fricke. 69 p. Leipzig, O. R. Reisland, 1902. [N]

The dates of publication of the plates of edition two are only partly given on the plates. For convenience in reference all of the dates are here given, those inclosed in brackets being taken from Friedländer's Naturae Novitates issued on the dates given, all others being taken from the plates.

Series I.	Heft 1– 6.	pl. 1– 24.	1 Ag 1885.
	Heft 7– 8.	pl. 25– 30.	1 S 1885.
		pl. 31– 32.	1 D 1885.
	Heft 9.	pl. 33– 36.	1 Ja 1886.
	Heft 10.	pl. 37– 40.	1 Mr 1886.
	Heft 11.	pl. 41– 44.	1 Ap 1886.
	Heft 12.	pl. 45– 48.	1 My 1886.
Series II.	Heft 13.	pl. 49– 52.	15 Ag 1886.
	Heft 14–17.	pl. 53– 68.	1 S 1886.
	Heft 18–20.	pl. 69– 80.	15 Mr 1887.
	Heft 21–22.	pl. 81– 88.	Jl 1885.
	Heft 23–24.	pl. 89– 96.	1 Ja 1886.
Series III.	Heft 25–26.	pl. 97–104.	1 Ag 1886.
	Heft 27–28.	pl. 105–112.	1 N 1886.
	Heft 29–30.	pl. 113–120.	[Ap 1888.]
	Heft 31–32.	pl. 121–128.	1 Ag 1888.
	Heft 33–34.	pl. 129–136.	[N 1888.]
	Heft 35–36.	pl. 137–144.	[1889.]
Series IV.	Heft 37–38.	pl. 145–152.	[Fe 1890.]
	Heft 39–40.	pl. 153–160.	N 1890.[a]
	Heft 41–42.	pl. 161–168.	Je 1891.]
	Heft 43–44.	pl. 169–176.	[My 1892.]
	Heft 45.	pl. 177–180.	[N 1892.]
	Heft 46.	pl. 181–184.	1 Jy 1893.
	Heft 47.	pl. 185–188.	15 O 1893.
	Heft 48.	pl. 189–192.	[S 1894.]
Series V.	Heft 49.	pl. 193–196.	[S 1894.]
	Heft 50.	pl. 197–200.	[Ap 1895.]
	Heft 51.	pl. 201–204.	[O 1896.]
	Heft 52–53.	pl. 205–212.	[Mr 1897.]
	Heft 54.	pl. 213–216.	[Mr 1899.]
	Heft 55.	pl. 217–220.	[N 1899.]
	Heft 56.	pl. 221–224.	N 1900.
	Heft 57.	pl. 225–228.	S 1901.
	Heft 58.	pl. 229–232.	Ap 1902.
	Heft 59–60.	pl. 233–240.	O 1902.
Series VI.	Heft 61.	pl. 241–244.	S 1903.
	Heft 62–63.	pl. 245–252.	Mr 1904.
	Heft 64.	pl. 253–256.	Ag 1905.
	Heft 65.	pl. 257–260.	S 1905.
	Heft 66.	pl. 261–264.	Je 1906.
	Heft 67.	pl. 265–268.	D 1906.

These dates were worked out by the author a few months before their publication by B. B. Woodward, Journ. Bot. **44**: 384–386. 1906. Mr. Woodward has recorded the exact date of receipt of heft 48–65 at the Botanical Department of the British Museum, which may be an additional advantage in some cases since only the month of publication is recorded on the plate or in Friedländer's Naturae Novitates.

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[a] Date at bottom of explanation of plate 153 overlooked by Mr. Woodward.

Schmidt, ADOLF. Die in den grundproben der nordseefahrt vom 21 Juli bis 9 Sept. 1872 enthaltenen diatomaceen. **Jahresb. Komm. Deut. Meere, 2:** 81–96. pl. 1–3. 1874. AGR.

A blue print copy of the above article has been issued privately to several diatomists, size reduced to 20½ cm.

Schneider, OSCAR. Naturwissenschaftliche beiträge zur kenntniss der Kaukasusländer, auf grund seiner sammelbeute. 160 p. 5 pl. Dresden, E. Blockmann & Sohn, 1878. 25 cm. LC.

Schrift. Phys.-Ökon. Gesell. Königsb. Schriften der Physikalisch-Ökonomischen Gesellschaft zu Königsberg. AGR.

Cleve, P. T. & Jentzsch, A **22:** 129–170. 1882.
Schumann, J. **3:** 166–192. 1863. **5:** 13–23. 1864. **8:** 37–68. 1867. **10:** 83–88. 18869.

Schultze, EDWIN A. Note on a variety of Asteromphalus roperianus Grev. **Bull. Torr. Club, 14:** 96. 1887.

Schultze, EDWIN A. A descriptive list of the Staten Island diatoms. **Bull. Torr. Club, 14:** 69–73; 109–114. pl. 66, 69. 1887. **16:** 98–104. pl. 90. 1889.

Schultze, MAX SIGISMUND. Phenomena of internal movements in Diatomaceae of the North sea, belonging to the genera Coscinodiscus, Denticella, and Rhizosolenia. **Quart. Journ. Micr. Sci. 7:** 13–21. pl. 2. 1859.

Schultze, MAX SIGISMUND. Die structur der diatomeenschale, vergliechen mit gewissen aus fluorkiesel künstlich darstellbaren kieselhäuten. **Verh. Naturhist. Ver. Rheinl. u. Westph. 20:** 1–41. pl. 1. 1863.

Translation in Quart. Journ. Micr. Sci. N. S. **3:** 120–134. 1863.

Schum. SCHUMANN, JULIUS. Preussische diatomaceen. **Schrift. Phys. Ökon. Gesell. Königsb. 3:** 166–192. pl. 8–9. 1863. **5:** 13–23. pl. 2. 1864. **8:** 37–68. pl. 1–3. 1867. **10:** 83–88. pl. 2. 1869.

Schum. SCHUMANN, JULIUS. Die diatomeen der hohen Tatra. **Verh. Zool. Bot. Ges. Wien, Suppl. 17:** 1–102. pl. 1–4. 1867.

Schütt, FRANZ. Arten von Chaetoceras und Peragallia. Ein beitrag zur hochseeflora. **Ber. Deut. Bot. Ges. 13:** 35–48. pl. 4–5. 1895.

Schütt, FRANZ. in **Eng. & Pr. Pflanzenfam.** *See* **Engler,** A. UND **Prantl,** K.

S. F. Gray, Nat. Arr. *See* **Gray,** S. F.

Shadb. SHADBOLT, GEORGE. On the structure of the siliceous loricae of the genus Arachnoidiscus. **Trans. Micr. Soc. Lond. 3:** 49–55. pl. 11. 1852.

This number is missing from the Smithsonian collection, having been lost or misplaced.

Shadb. SHADBOLT, GEORGE. A short description of some new forms of Diatomaceae from Port Natal. **Trans. Micr. Soc. Lond. N. S. 2:** 13–18. pl. 1. 1854.

Shrubs. & Kitt. SHRUBSOLE, W. H. AND KITTON, FREDERIC. The diatoms of the London clay. **Journ. Roy. Micr. Soc.** II. **1^3:** 381–387. pl. 5. f. 1. 1881.

Smith, HAMILTON LANPHERE. Conspectus of the families and genera of the Diatomaceae. **The Lens, 1:** 1–19; 72–93; 154–157. 1872.

Smith, HAMILTON LANPHERE. Conspectus of the Diatomaceae. Analysis of the species of the genus Amphora. **The Lens, 2:** 65–91. pl. 1–3. 1873.

Smith, HAMILTON LANPHERE. Species diatomacearum typicae. (—p.) New York. 1874. NM.

Accompanied by slides.

Smith, HAMILTON LANPHERE. Notes on Cent. I of the "Species typicae diatomacearum." **Am. Journ. Micr. 2:** 99–103. 1877.

Smith, HAMILTON LANPHERE. A contribution to the life history of the Diatomaceae. **Proc. Am. Soc. Micr. 8:** 30–66. pl. 1–5. f. 1–14. 1886. **9:** 126–167. pl. 1–6. f. 1–6. 1888.

Smith, Sir James Edward. The English flora, by Sir James Edward Smith. 5 v. in 6. London, Longman, Rees, Orme, Brown, Green, & Longman, 1824–36. LC. Agr.

Diatomaceae, v. 5. p. 401–415. 1833.

Smith, Rev. William. Notes on the Diatomaceae; with descriptions of British species included in the genera Campylodiscus, Surirella and Cymatopleura. **Ann. Mag. Nat. Hist.** II. **7:** 1–14. pl. 1–3. 1851.

Smith, Rev. William. Notes on the Diatomaceae; with descriptions of British species included in the genus Pleurosigma. **Ann. Mag. Nat. Hist.** II. **9:** 1–12. pl. 1–2. 1852.

Smith, Rev. William. A synopsis of the British Diatomaceae; with remarks on their structure, functions and distribution; and instructions for collecting and preserving specimens . . . The plates by Tuffen West. v. 1. xxxiv, 89 p. 31 pl. [incl. front.]. 1853. v. 2. xxx, 107 p. pl. 32–42, A–E [incl. front.]. 1856. London, Smith and Beck, 1853–6. 26 cm. Agr.

Smith, Rev. William. Notes on an excursion to the south of France and the Auvergne in search of Diatomaceae. **Ann. Mag. Nat. Hist.** II. **15:** 1–9. pl. 1. 1855.

Smith, Rev. William. On the determination of species in the Diatomaceae. **Quart. Journ. Micr. Sci. 3:** 130–135. 1855.

Smith, Rev. William. Notes on an excursion to the Pyrenees in search of Diatomaceae. **Ann. Mag. Nat. Hist.** II. **19:** 1–13. pl. 1–2. 1857.

Smithson. Contr. Knowl. Smithsonian Contributions to Knowledge. Sm. Agr.

Bailey, J. W. **2**^{3}: 1–15. 1851. **2**^{8}: 1–48. 1851 **7:** 1–16. 1854.

Stolt. Stolterfoth, Henry. On a new species of the genus Eucampia. **Journ. Roy. Micr. Soc. 2:** 835–836. f. a–d. 1879.

Ströse, Bacillarienlager. Ströse, K. Das Bacillarienlager bei Klieken in Anhalt von K. Ströse. 1 p. l. 26 p. 2 pl. Dessau, L. Reiter, 1884. 28 cm.

. . . Herzogliches realgymnasium zu Dessau. Festschrift zur XXXVII versammlung Deutscher Philologen und Schulmänner zu Dessau in den tagen vom 1–4 Oktober 1884.

Sv. Vet.-Akad. Handl. Kongl. Svenska Vetenskaps-Akademiens Handlingar. Agr.

Cleve, P. T. & Grunow, A. **17**^{2}: 1–121. 1880. **18**^{5}: 1–28. 1881. Cleve, P. T. **26**^{2}: 1–194. 1894. **27**^{3}: 1–219. 1895. **34**^{1}: 1–22. 1900. **34**^{2}: 1–75. 1900. **34**^{3}: 1–21. 1900.

Temp. & Br. *See* **Br. & Temp.**

Thw. Thwaites, George Henry Kendrick. On conjugation in the Diatomaceae. **Ann. Mag. Nat. Hist. 20:** 9–11. pl. 4. 1847.

Thw. Thwaites, George Henry Kendrick. Further observations on the Diatomaceae; with descriptions of new genera and species. **Ann. Mag. Nat. Hist.** II. **1:** 161–172. pl. 11–12. 1848.

Toni, Giovanni Battista de, *i. e.* Johannes Baptista de. Sylloge algarum omnium hucusque cognitarum. v. 2. Bacillarieae. Sectio I. Rhaphideae, 3 p. l. cxxxii, 490 p. 1891. Sectio II. Pseudorhaphideae, 3 p. l. p. 491–817. 1892. Sectio III. Cryptorhaphideae, 3 p. l. p. 819–1556. Repertorium, 8, ccxiv p. 1894. Patavii, sumptibus auctoris typis seminarii, 1891–94. 24 cm.

Bibliotheca diatomologica seu catalogus librorum et collectionum exsiccatarum Bacillarieas quascumque sistentium, curante J[ulien] Deby. Sectio I. p. v–cxxxii.

Repertorium geographico-polyglottum in usum Sylloges algarum omnium, curavit Hector i. e. Ettore de Toni. Agr.

Townsend, C. H. Dredgings and other records of the United States Fish Commission steamer Albatross, with bibliography relative to the work of the vessel. **Rept. U. S. Comm. Fish. 1900:** 387–562. pl. 1–7. 1901.

Trans. Am. Micr. Soc. Transactions of the American Microscopical Society. LC.
Bessey, C. E. **21**: 61-85. 1900.

Trans. Bot. Soc. Edinb. Transactions of the Botanical Society. Edinburgh. NM. Agr.
Greville, R. K. **8**: 233-238; 436-441. 1866.

Trans. Micr. Soc. Lond. Transactions of the Microscopical Society of London. Series II. LC. Surg.
Series II. v. 1-15 bound with **Quart. Journ. Micr. Sci.**
Arnott, G. A. Walker-. **6**: 85-87. 1858.
Donkin, A. S. **6**: 12-34. 1858.
Gregory, W. **1**: 92-99. 1853. **2**: 104-106. 1854. **3**: 10-15. 1855. **4**: 35-48. 1856. **5**: 67-88. 1857.
Greville, R. K. **8**: 28-32; 102-124. 1860. **9**: 39-45; 67-87. 1861. **10**: 18-29; 41-55; 89-96. 1862. **11**: 13-21; 36-53; 63-76. 1863. **12**: 8-14; 81-94. 1864. **13**: 1-10; 24-34; 43-75; 97-105. 1865. **14**: 1-9. 77-86; 121-130. 1866.
Lauder, H. S. **12**: 6-8; 75-79. 1864.
Norman, G. **8**: 59-71. 1860. **9**: 5-9. 1861.
Roper, F. C. S. **2**: 67-80. 1854. **7**: 1-24. 1859. **8**: 55-58. 1860. **11**: 53-62. 1863.
Shadbolt, G. **2**: 13-18. 1854.
Wallich, G. C. **8**: 36-55. 1860.
West, T. **6**: 147-153. 1860.

Trans. N. Y. Acad. Sci. Transactions of the New York Academy of Sciences. NM. Agr.
Ries, H. **13**: 165-169. 1894.

Trans. Roy. Soc. Edinb. Transactions of the Royal Society of Edinburgh. SC.
Gregory, W. **21**: 473-542. 1851.

Trans. Wisc. Acad. Transactions of the Wisconsin Academy of Sciences, Arts and Letters. NM. Agr.
Blake, W. P. **14**: 107-111. 1903.

Truan. Truan y Luard, Alfredo. Ensayo sobre la sinopsis de las diatomeas de Asturias. **Anal. Soc. Españ. Hist. Nat. 13**: 307-364. pl. 7-10. 1884. **14**: 239-256. pl. 2-5. 1885.

Truan & Witt, Diat. Hayti. Truan y Luard, Alfredo und Witt, Otto N. Die diatomaceen der polycystinenkreide von Jérémie in Hayti, Westindien. 24 p. 7 pl. Berlin, R. Friedländer & Sohn, 1888. 30½ cm. Agr.

Turp. Turpin, P. J. F. Observations sur le nouveau genre Surirella. **Mem. Mus. Hist. Nat. 16**: 361-368. pl. 15. 1828.

U. S. Exploring Expedition. During the years 1838-1842, under the command of Charles Wilkes, U. S. N. LC. Agr.
Bailey & Harvey, Diatomaceae. **17**: 175-182. The completed report included in volume 17 did not appear until 1874. The diatomaceae however were first published by Harvey & Bailey. **Proc. Acad, Phila. 6**: 430-431. 1854, and reprinted in **Quart. Journ. Micr. Sci. 3**: 93-94. 1855.

Van Heur. Synop.—Treat. Diat.—Types. *See* **Heurck,** Henri van.

Verh. Naturhist. Ver. Rheinl. u. Westph. Verhandlungen des Naturhistorischen Vereins der Preussischen Rheinlände und Westphalens. Bonn. SC.
Schultze, M. S. **20**: 1-41. 1863.

Verh. Russ. Micr. Gesell. Verhandlungen der Russisch-kaiserlichen mineralogischen Gesellschaft zu St. Petersburg. Series II. [ЗАПИСКИ ИМПЕРАТОРСКАГО С. ПЕТЕРБУРГСКАГО МИНЕРАЛОГИЧЕСКАГО ОБЩЕСТВА. ВТОРАЯ СЕРІЯ.] GS.
Witt, O. N. II. **22**: 137-177. 1886.

Verh. Zool. Bot. Ges. Wien. Verhandlungen der kaiserlich-königlichen zoologisch-botanischen Gesellschaft in Wien. Agr.
Grunow, A. **10**: 503-582. 1860. **12**: 315-472; 545-588. 1862. **13**: 137-162. 1863.

Walk. & Chase, Notes on Diatoms. Walker, W. C. and Chase, Harvey H. Notes on some new or rare diatoms. 3 ser. in 2 pts. Utica, N. Y. Curtiss & Childs and Flint, Mich. Daily News Print. 1886-1887. 27 cm.
Ser. I. 6 p. 2 pl. 1.
Ser. II-III. 12 p. 3 pl.

Wallich, G. C. On Triceratium and some new allied forms, with figures of the same. **Quart. Journ. Micr. Sci. 6:** 242–253. pl 12–13. 1858.

Wallich, G. C. On the siliceous organisms found in the digestive cavities of Salpae, and their relation to the flint nodules of the chalk formation. **Trans. Micr. Soc. Lond. N. S. 8:** 36–55. pl. 2. 1860.

Weisse, J. F. Nachricht über einen staubfall, welcher sich im jahre 1834 im gouvernement Irkutsk ereignet hat. **Mel. Biol. Acad. Sci. St. Petersb. 1:** 275–281. pl. 1–2. 1851.

Weisse, J. F. Mikroskopische analyse eines organischen polirschiefers aus dem gouvernement Simbirsk. **Mel. Biol. Acad. Sci. St. Petersb. 2:** 237–250. pl. 1–3. 1855.

Weisse, J. F. Die diatomaceen des Badeschlammes von Arensburg und Hapsal, wie auch des sogenannten mineralschlammes der Soolen-Badeanstalt in Staraja-Russa. **Mel. Biol. Acad. Sci. St. Petersb. 3:** 357–362. pl. 1. 1860.

Weisse, J. F. Diatomaceen des Ladoga-sees. **Mel. Biol. Acad. Sci. St. Petersb. 4:** 659–664. pl. 1. 1865.

Weisse, J. F. Fernere untersuchungen von grundproben aus dem Ladoga-see auf diatomaceen. **Mel. Biol. Acad. Sci. St. Petersb. 5:** 105–108. pl. 1. 1865.

Weisse, J. F. Mikroskopische untersuchung des guano. **Mel. Biol. Acad. Sci. St. Petersb. 6:** 303–311. pl. 1–2. 1867.

Weisse, J. F. Mikroskopische untersuchung des guano. **Bull. Acad. St. Petersb. 12:** 120–125. pl. 1–2. 1868.

West, Tuffen. On the structure of Rhabdonema and other Diatomaceae with compound frustules. **Quart. Journ. Micr. Sci. 6:** 186–188. 1858.

West, Tuffen. Remarks on some Diatomaceae, new or imperfectly described, and a new desmid. **Trans. Micr. Soc. Lond. N. S. 6:** 147–153. pl. 7. 1860.

Wigand, A. Bemerkungen über einige diatomaceen. **Hedwigia, 2:** 41–46. pl. 7. 1860.

Wildem. Alg. Buitenz. Wildeman, E. de. Les Algues de la flore de Buitenzorg; essai d'une flore algologique de Java. xi, 457 p. 16 pl. 149 f. Leide, E. J. Brill. 1900. 25½ cm.

Diatomaceae. p. 156–371. f. 47–138.

Williamson, W. C. On a new British species of Campylodiscus. **Ann. Mag. Nat. Hist.** II. **1:** 321–322. f. 1. 1848.

Witt, Otto N. Bericht über die untersuchung zweier diatomaceen-gemische. Ein beitrag zur kenntniss der flora der südsee. **Journ. Mus. Godef. 1:** 63–70. pl. 8. 1873.

Witt, Otto N. Ueber den polierschiefer von Archangelsk-kurojedowo im gouv. Simbirsk. **Verh. Russ. Min. Gesell.** II. **22:** 137–177. pl. 6–12. 1886. AGR.*

Wolle, Diat. N. A. Wolle, Francis. Diatomaceae of North America, illustrated with twenty-three hundred figures from the author's drawings. p. i–xiii, 15–47. 1 l. 112 pl. with explanatory leaves. port. Bethlehem, Pa. The Comenius Press. 1890. 24½ cm. AGR.

Woolman, Lewis. A review of artesian well horizons in southern New Jersey. With notes of new wells in New Jersey, Delaware and South Carolina and also in Philadelphia, Pa. **Rep. Sta. Geol. N. J. 1891:** 223–232. pl. 1. 1892.

Reprinted 1 p. l. 12 p. 1 pl. 1892.

W. Smith, Synop. Brit. *See* **Smith,** William.

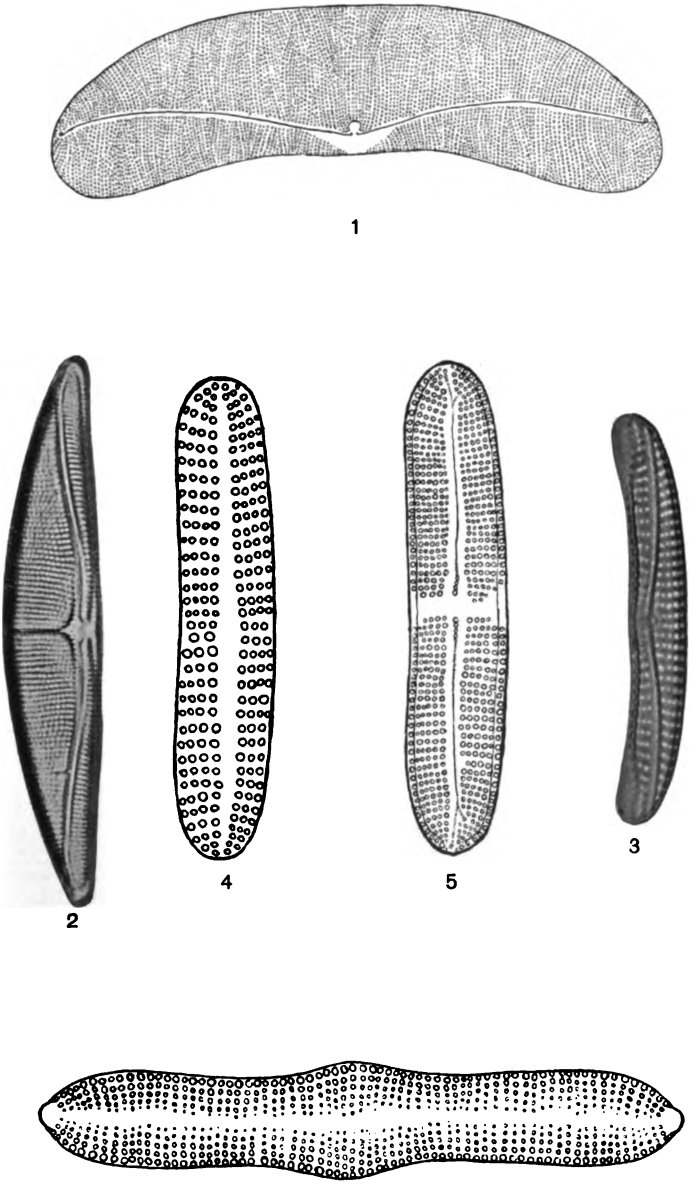
Zeitsch. Deut. Geol. Gesell. Zeitschrift der Deutschen geologischen Gesellschaft. GS.

Noetling, F. 35: 318–354. 1883.

PLATE XLIV.

PLATE XLIV.

FIG. 1.—*Amphora honshuensis* Mann. Enlarged 500 diameters. Description, p. 375.
FIG. 2.—*Amphora baccata* Mann. Enlarged 575 diameters. Description, p. 373.
FIG. 3.—*Amphora crescens* Mann. Enlarged 600 diameters. Description, p. 374.
FIG. 4.—*Achnanthes dispar* Mann. Enlarged 800 diameters. Description, p. 327.
FIG. 5.—*Achnanthes dispar* Mann. Enlarged 800 diameters. Description, p. 327.
FIG. 6.—*Dimeregramma inflatum* Mann. Enlarged 1,000 diameters. Description, p. 327.



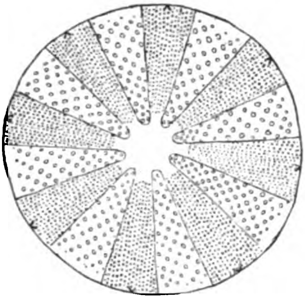
DIATOMS OF THE GENERA AMPHORA, ACHNANTHES, AND DIMEREGRAMMA.

PLATE XLV.

PLATE XLV.

FIG. 1.—*Actinoptychus alternans* Mann. **Enlarged 1,000 diameters. Description, p. 270.**
FIG. 2.—*Actinoptychus planus* Mann. **Enlarged 740 diameters. Description, p. 271.**
FIG. 3.—*Actinoptychus radulus* Mann. **Enlarged 575 diameters. Description, p. 271.**
FIG. 4.—*Asteromphalus nanus* Mann. **Enlarged 612 diameters. Description, p. 276.**
FIG. 5.—*Asteromphalus van heurckii* Mann. **Enlarged 660 diameters. Description, p. 276.**
FIG. 6.—*Stephanopyxis trisculpta* Mann. **Enlarged 550 diameters. Description, p. 245.**

PLATE XLV.



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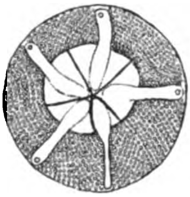

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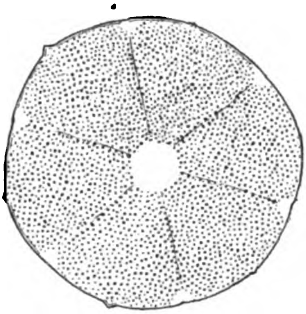

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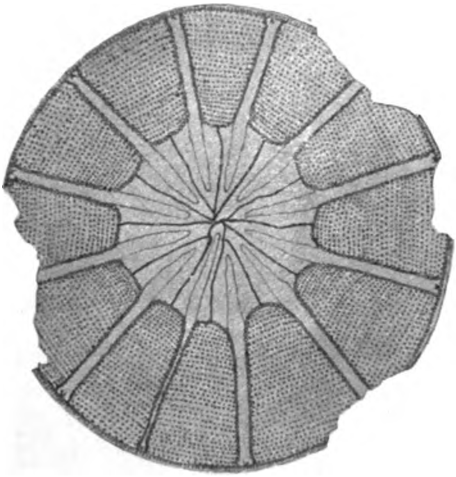

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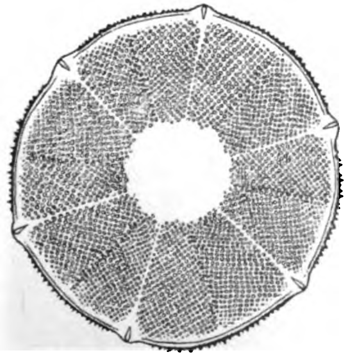

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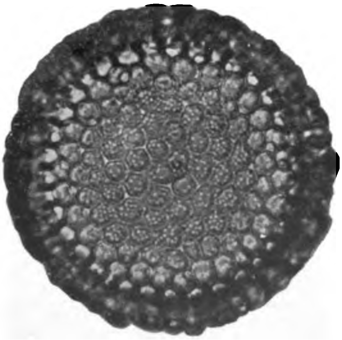


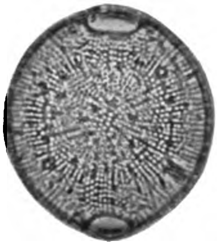
6

DIATOMS OF THE GENERA ACTINOPTYCHUS, ASTEROMPHALUS, AND STEPHANOPYXIS.

PLATE XLVI.

PLATE XLVI.

FIG. 1.—*Biddulphia alaskiensis* Mann. Enlarged 550 diameters. Description, p. 298.
FIG. 2.—*Biddulphia roperiana* Grev. (a smooth variety). Enlarged 400 diameters. Description, p. 308.
FIG. 3.—*Biddulphia culcitella* Mann. Enlarged 660 diameters. Description, p. 300.
FIG. 4.—*Biddulphia subjuncta* Mann. Enlarged 660 diameters. Description, p. 311.
FIG. 5.—*Biddulphia luminosa* (Temp. and Br.) Mann. Enlarged 660 diameters. Description, p. 305.



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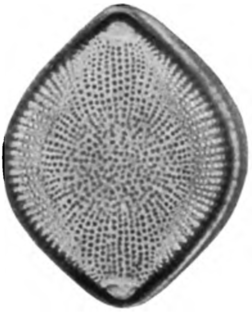

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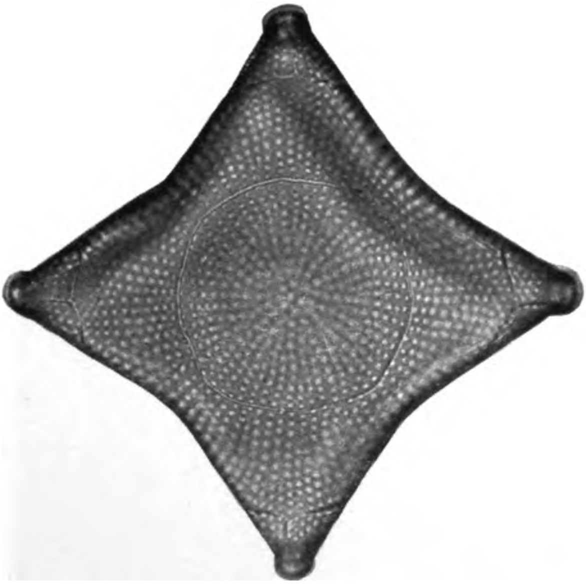

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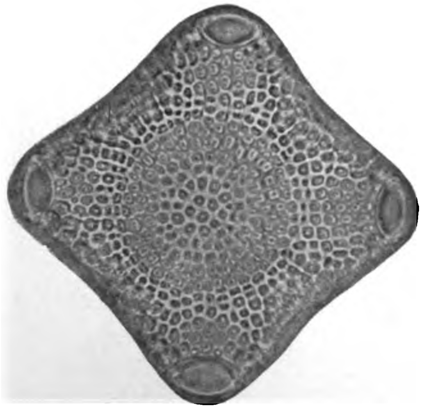

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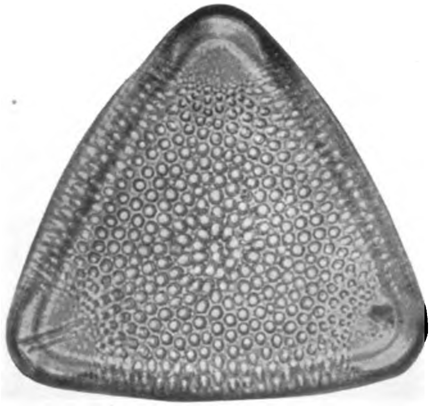


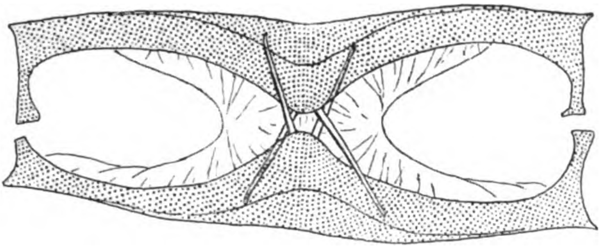
5

DIATOMS OF THE GENUS BIDDULPHIA.

PLATE XLVII.

PLATE XLVII.

FIG. 1.—*Biddulphia extensa* Mann (zonal view). **Enlarged 575 diameters. Description, p. 302.**
FIG. 2.—*Biddulphia extensa* Mann (valval view). **Enlarged 575 diameters. Description. p. 302.**
FIG. 3.—*Biddulphia scutellum* Mann. **Enlarged 375 diameters. Description, p. 309.**
FIG. 4.—*Biddulphia gladiorum* Mann. **Enlarged 750 diameters. Description, p. 304.**



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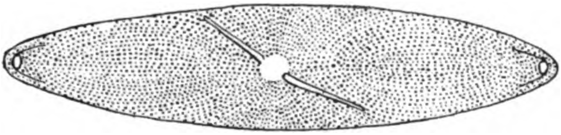

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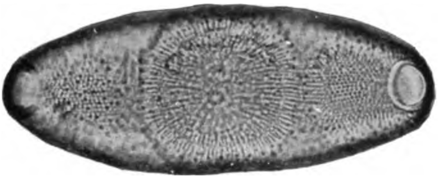

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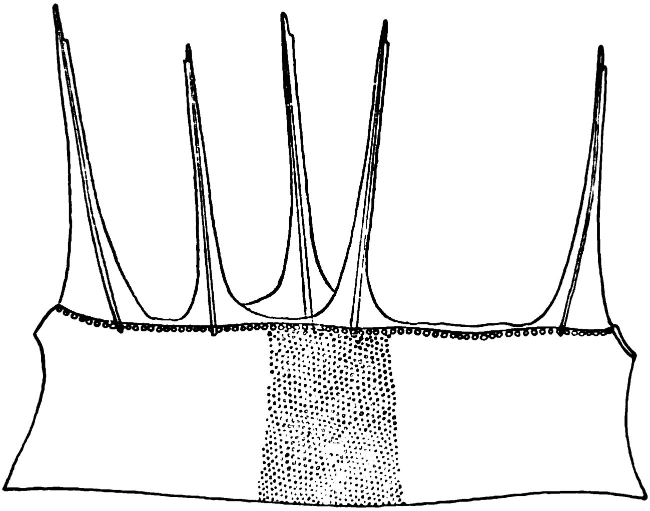


4

DIATOMS OF THE GENUS BIDDULPHIA.

PLATE XLVIII.

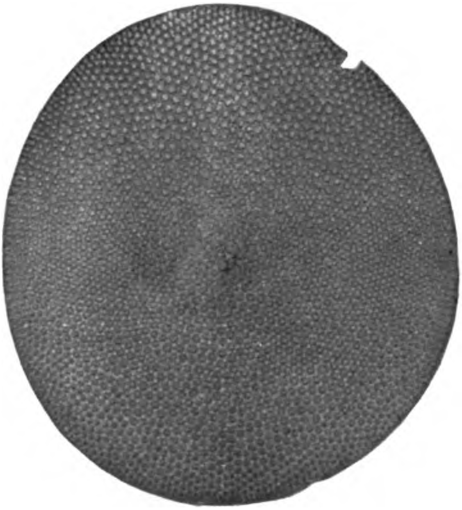
PLATE XLVIII.

FIG. 1.—*Coscinodiscus deformatus* Mann. Enlarged 550 diameters. Description, p. 250.

FIG. 2.—*Coscinodiscus deformatus* Mann. Enlarged 550 diameters. Description, p. 250.

FIG. 3.—*Coscinodiscus pustulatus* Mann. Enlarged 375 diameters. Description, p. 257.

FIG. 4.—*Coscinodiscus robustus* Grev. (variety with open girdle). Enlarged 375 diameters. Description, p. 258.



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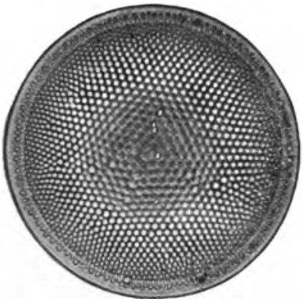

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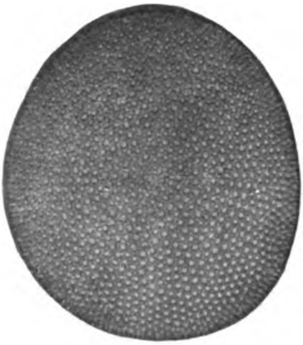

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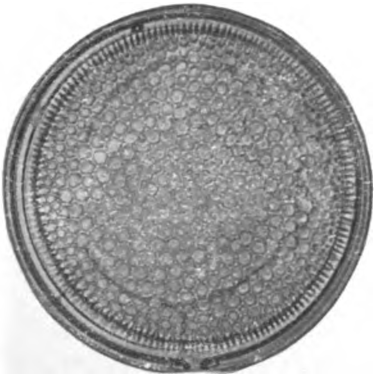


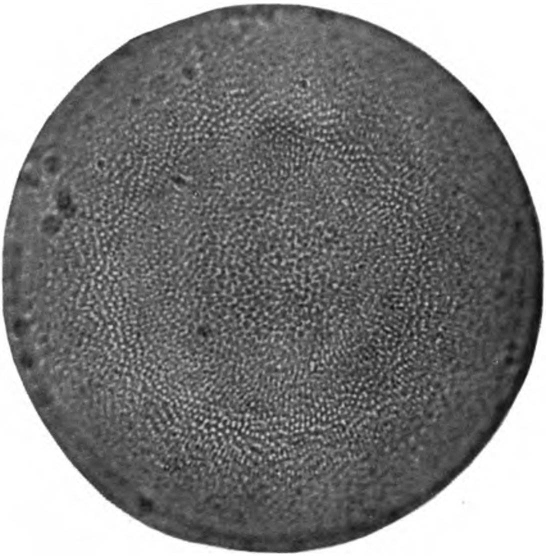
4

DIATOMS OF THE GENUS COSCINODISCUS.

PLATE XLIX.

PLATE XLIX.

FIG. 1.—*Coscinodiscus undulosus* Mann. Enlarged 550 diameters. Description, p. 259.
FIG. 2.—*Coscinodiscus marginatus* Ehrenb. variety (?) Enlarged 875 diameters. Description, p. 253.



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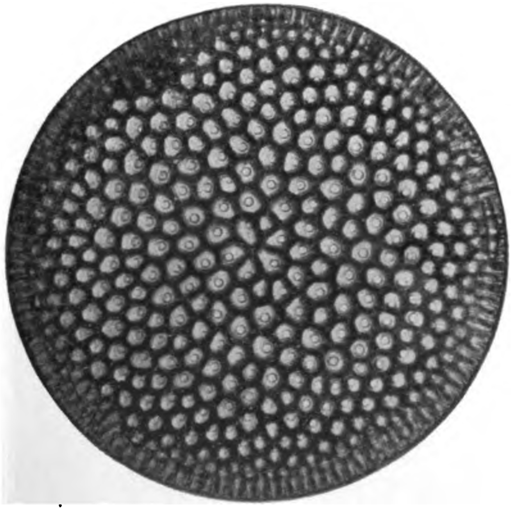


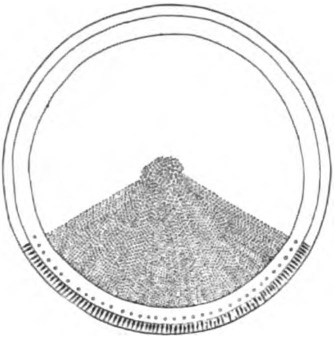
2

DIATOMS OF THE GENUS COSCINODISCUS.

PLATE L.

PLATE L.

FIG. 1.—*Coscinodiscus verecundus* Mann. Enlarged 500 diameters. Description, p. 259.
FIG. 2.—*Cyclotella regina* Mann. Enlarged 500 diameters. Description, p. 265.
FIG. 3.—*Melosira medusa* Mann. Enlarged 500 diameters. Description, p. 238.
FIG. 4.—*Melosira scopos* Mann. Enlarged 600 diameters. Description, p. 239.
FIG. 5.—*Stictodiscus gelidus* Mann. Enlarged 600 diameters. Description, p. 268.
FIG. 6.—*Tripodiscus beringensis* Mann. Description, p. 278.



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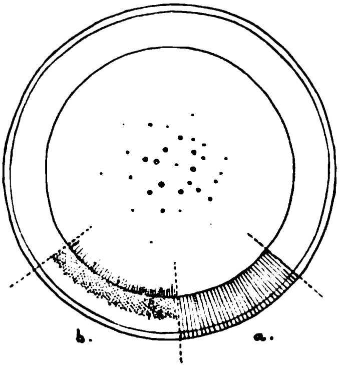

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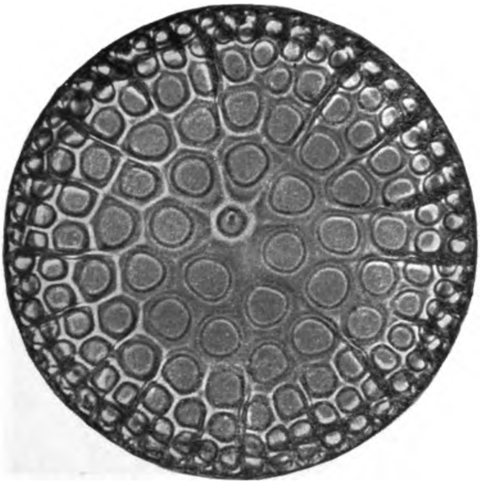

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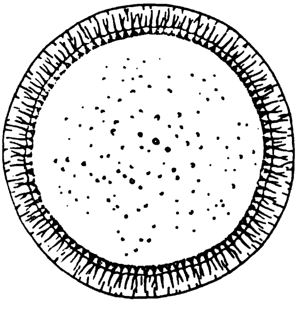

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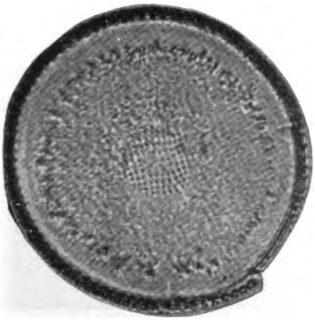

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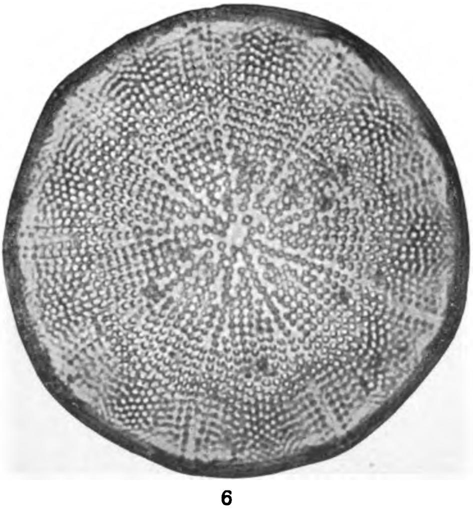


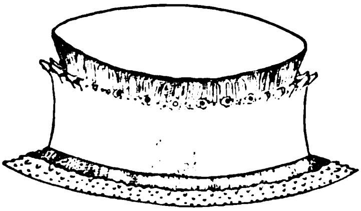
6

Diatoms of Several Genera.

PLATE LI.

PLATE LI.

FIG. 1.—*Melosira coronaria* Mann (zonal view). **Enlarged 600 diameters. Description, p. 237.**
FIG. 2.—*Melosira coronaria* Mann (valval view). **Enlarged 600 diameters. Description, p. 237.**
FIG. 3.—*Campylodiscus galapagensis* Mann. **Enlarged 300 diameters. Description, p. 387.**
FIG. 4.—*Trigonium rusticum* Mann. **Enlarged 600 diameters. Description, p. 294.**
FIG. 5.—*Trigonium adspersum* Mann. **Enlarged 600 diameters. Description, p. 292.**



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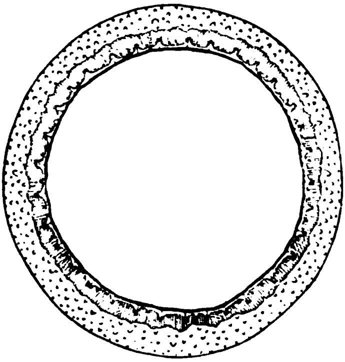

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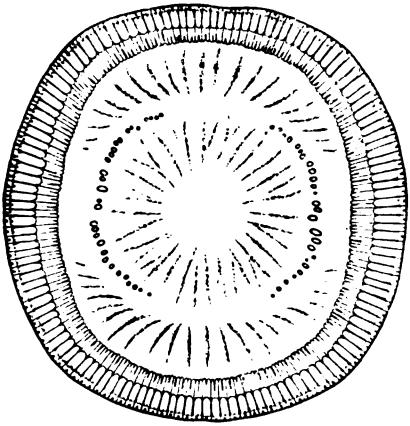

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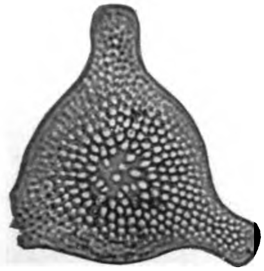

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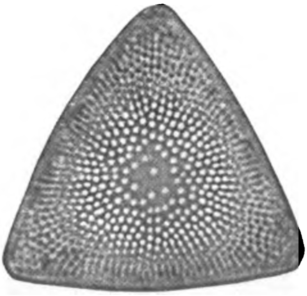

5

DIATOMS OF THE GENERA MELOSIRA, CAMPYLODISCUS, AND TRIGONIUM.

PLATE LII.

PLATE LII.

FIG. 1.—*Plagiogramma sceptrum* Mann (valval view). **Enlarged 375 diameters. Description, p. 326.**
FIG. 2.—*Plagiogramma sceptrum* Mann (zonal view). **Enlarged 375 diameters. Description, p. 326.**
FIG. 3.—*Navicula vidovichii* Grun. (form). **Enlarged 550 diameters. Description, p. 358.**
FIG. 4.—*Navicula curvilineata* Mann. **Enlarged 515 diameters. Description, p. 341.**
FIG. 5.—*Navicula speciosa* Mann. **Enlarged 550 diameters. Description, p. 356.**
FIG. 6.—*Navicula gyrinida* Mann. **Enlarged 660 diameters. Description, p. 344.**
FIG. 7.—*Navicula spuma* Mann. **Enlarged 600 diameters. Description, p. 357.**

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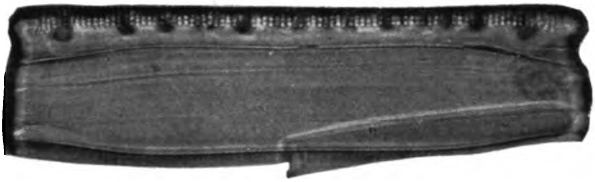

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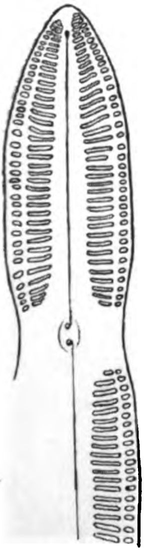

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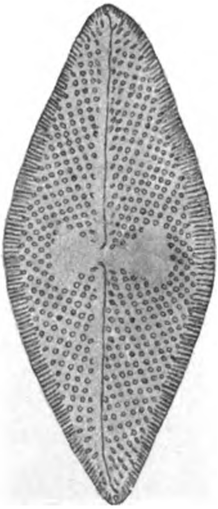

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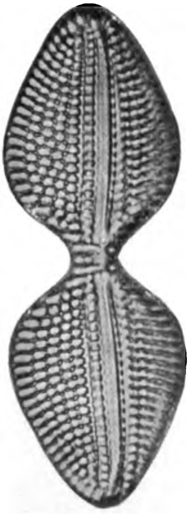

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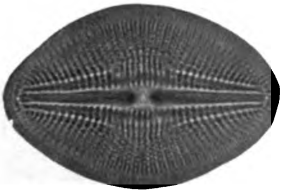

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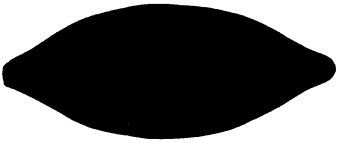


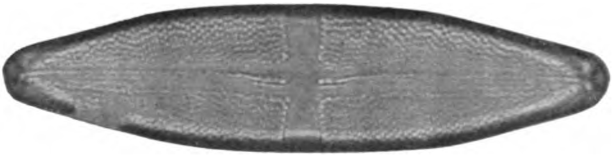
7

DIATOMS OF THE GENERA PLAGIOGRAMMA AND NAVICULA.

PLATE LIII.

PLATE LIII.

FIG. 1.—*Navicula undata* Mann. **Enlarged 990 diameters. Description, p. 358.**
FIG. 2.—*Navicula ardua* Mann (valval view). **Enlarged 600 diameters. Description, p. 336.**
FIG. 3.—*Navicula ardua* Mann (zonal view). **Enlarged 600 diameters. Description, p. 336.**
FIG. 4.—*Navicula prodiga* Mann. **Enlarged 600 diameters. Description, p. 352.**
FIG. 5.—*Navicula pinguis* Mann. **Enlarged 375 diameters. Description, p. 350.**
FIG. 6.—*Navicula invenusta* Mann (type). **Enlarged 375 diameters. Description, p. 346.**
FIG. 7.—*Navicula invenusta* Mann (form). **Enlarged 375 diameters. Description, p. 346.**



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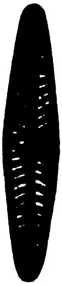

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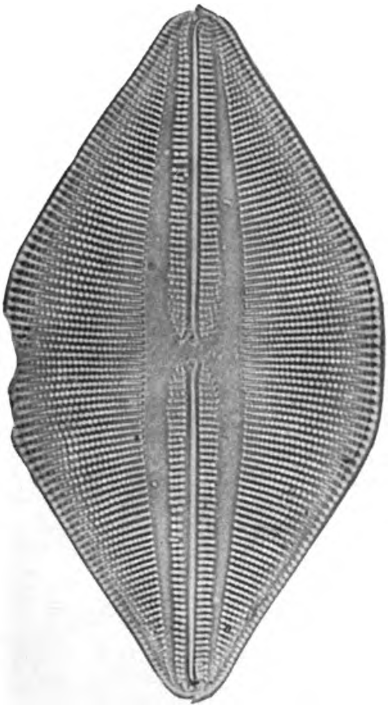

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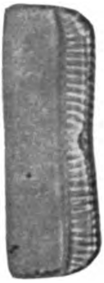

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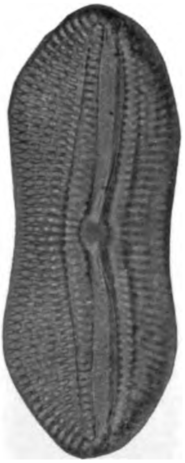

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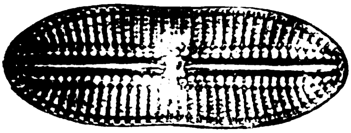

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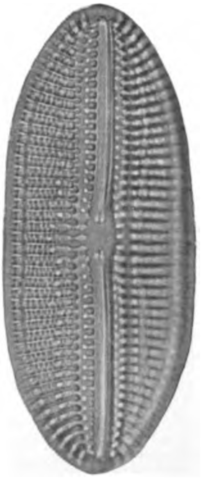

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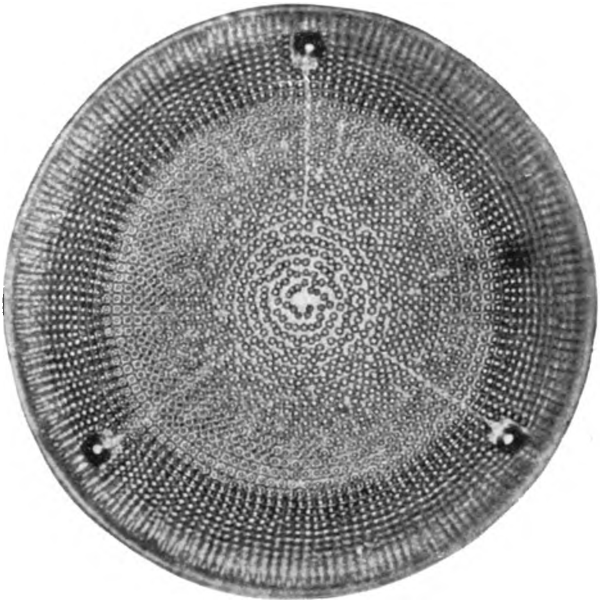
DIATOMS OF THE GENUS NAVICULA.

PLATE LIV.

PLATE LIV.

FIG. 1.—*Tripodiscus concentricus* Mann (type). **Enlarged 600 diameters. Description, p. 278.**
FIG. 2.—*Tripodiscus concentricus* Mann (form). **Enlarged 600 diameters. Description, p. 278.**
FIG. 3.—*Tripodiscus laxus* Mann. **Enlarged 550 diameters. Description, p. 279.**
FIG. 4.—*Tripodiscus cosmiodiscus* Mann. **Enlarged 550 diameters. Description, p. 279.**

PLATE LIV.



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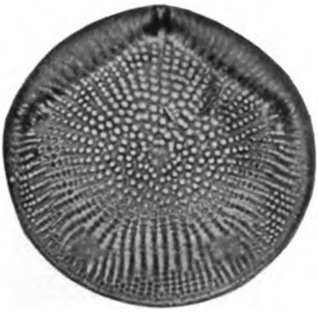

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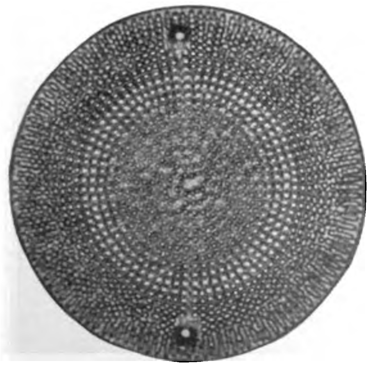

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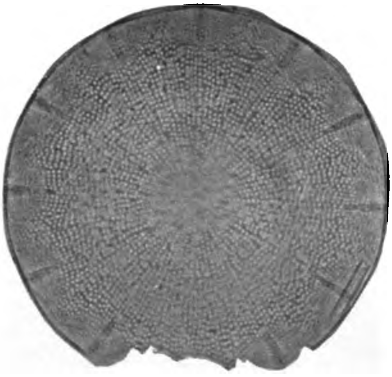

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DIATOMS OF THE GENUS TRIPODISCUS.

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SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM

# CONTRIBUTIONS
FROM THE
UNITED STATES NATIONAL HERBARIUM

VOLUME X, PART 7

STUDIES OF TROPICAL AMERICAN FERNS—NO. 1

By WILLIAM R. MAXON

WASHINGTON
GOVERNMENT PRINTING OFFICE
1908

BULLETIN OF THE UNITED STATES NATIONAL MUSEUM:

ISSUED MARCH 30, 1908.

PREFACE.

During the last decade the National Museum has acquired large collections of Mexican and Central American plants. These collections are rich in new material but evidently they are not sufficiently comprehensive to warrant undertaking the publication of a general flora of any one of these countries without further exploration. In order, however, to make public the scientific results of preliminary studies of the collections a series of papers has been carried on in the Contributions from the National Herbarium under the title, "Studies of Mexican and Central American Plants," by Dr. J. N. Rose, associate curator. It is now proposed to begin a similar series under the title, "Studies of Tropical American Ferns," by Mr. William R. Maxon, assistant curator. Although at present this will deal largely with Mexican and Central American collections, it will include also descriptions of new and noteworthy West Indian species. South American forms will be considered also, as circumstances may require.

FREDERICK V. COVILLE,
Curator of the United States National Herbarium.

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STUDIES OF TROPICAL AMERICAN FERNS—NO. 1.

By William R. Maxon.

INTRODUCTION.

In this and following papers it is the purpose of the writer to present under a collective title some results of studies of tropical American ferns, especially those of the West Indies, Mexico, and Central America. The matter is designed to include notes on some of the earlier species, corrections in nomenclature, descriptions of new species and, when material warrants, revisions of certain genera and smaller groups of species.

A considerable number of the early species, of those even which have figured longest in literature, are still imperfectly understood and not infrequently appear under wrong names. To determine with exactness these historic species is of much taxonomic importance. The accomplishment of this, often a matter of extensive detail, is made vastly easier than formerly to American students by the large series of specimens gathered in recent years by American collectors; but even with these at hand there remain other considerations which render the serious study of so variable a group more than ordinarily difficult. As chief of these—aside from the usual insufficiency of the diagnoses and the location of the historic early collections, with their numerous types and frequently cited numbers, in European herbaria—may be mentioned the lack of attention given in the past to the matter of type localities and the failure to appreciate the fact of the more or less definite geographical distribution of species. From this there has resulted the greatest confusion.

To illustrate: The extent of variation even in a suite of specimens from a single locality in tropical America, these known absolutely to constitute but a single variable though definitely restricted species, is sometimes—and this in no one genus and no one tribe—little short of astounding. To such a series known under one name may have been joined a closely allied group from some other and perhaps distant region, this also with its various forms diverging, it may be, along quite different lines; and to this fast-growing "polymorphic species" may have been added a third and a fourth form, each with its attendant variations. If the herbarium material at hand is considerable and represents forms from a wide geographic range, the chance of determining with certainty the limits of the several species previously merged or confused is, naturally, improved; yet also the greater is the need of study and of a thorough search of literature in applying the names correctly. With only scant material available a brief diagnosis of a Jamaican or a Martinique plant might be thought to apply well enough to Mexican specimens, in the absence of specimens from the type region, and one name might be made to apply to the whole. If this happened a century ago the reference, whether right or not, may have the weight of monographic "authority" of the intervening period, and the present-day writer may be confronted with the need of determining the boundaries and relationship not of one, but of two, three, or more species, as the case may be. Or, the original form having been rare or not much collected since, the name given to this may have become fixed definitely upon a single species, but this very different from the original and possibly from a distant region. On the other hand, the older writer, in the lack of connecting forms since collected in abundance, may have recognized far too many "species." When, finally, the limits of the several allied species have been made out, it may appear that in the case of any or all of these which may have received names, the nomenclatorial type, having been determined not by selection but (often of necessity) by mere accident of first discovery, is not truly typical of the species and represents one of the outlying forms. Under these circumstances the nonavailability of a type specimen for comparison or, at least, a lack of knowledge as to its exact origin, becomes a doubly serious handicap.

It is not to be supposed that the difficulties mentioned exist in a study of the ferns alone, though it must be admitted that this group in particular has suffered radically diverse treatment at the hands of various students. This has resulted naturally from the circumstances. Fern species, partly by reason of their ready dispersal and their unusual breadth of variation, are commonly supposed to occupy extensive ranges that would at once be discredited for the great majority of phanerogams. Undoubtedly a very wide distribution is to be ascribed to many tropical ferns, mainly lowland species, and very many others in one form or another too close to be separated are known to stretch over half a continent; yet marked exceptions occur, as in the Cyatheaceae, which have been found to be relatively local in range and in which, as might be supposed, definite though minute diagnostic characters are noted upon painstaking study. Too few trustworthy modern data are available in published form to permit of more than general deductions as to geographic distribution. The problem often is, at present, to determine whether variations noted are local and essentially individual or, rather, are susceptible of correlation with geographic and physiographic factors.

In this connection the importance of further field work should not be underestimated. With the important exception of Santo Domingo and certain large areas in Cuba the West Indies have been fairly well covered within recent years. There remain on the North American continent Nicaragua, Salvador, Honduras, and the vast humid region of eastern Mexico. To the extreme south is Panama, connecting geographically the two continents, its flora nearly unknown but almost certainly containing the strong South American element noted in that of Costa Rica immediately to the north. The exploration of eastern Mexico at mid-elevations toward the lowlands seems especially desirable in order to bring to light many of the species described during the first half of the last century. Exploration of the other regions mentioned, particularly of Panama, is hardly less important, as certain to afford data bearing upon larger problems.

The writer wishes to extend his thanks to the curators of the herbaria mentioned later for courteously placing at his disposal for study numerous specimens which have been of material assistance.

ASPLENIUM SALICIFOLIUM AND CONFUSED SPECIES.

The *Asplenium salicifolium* of Linnæus has been almost universally misidentified. It was founded upon Plumier's plate 60, representing a plant described by Plumier with the remark that he had found it at "several places in the French islands of America." In identifying the Linnæan species, then, we should expect to associate this name with no very uncommon plant of the West Indies. To assist us there is a passable figure, somewhat idealized but yet showing a plant since many times collected and rarely if ever referred to under its right name—commonly, rather, as *Asplenium auriculatum* Sw., a name given originally to Brazilian specimens. Ample Brazilian material, lacking in American herbaria, might show the true *A. auriculatum* to be a different species from the West Indian specimens passing under that name, though this is certainly to be doubted; but in any event these West Indian specimens undoubtedly represent the true *Asplenium salicifolium* of Linnæus, as the following notes are intended to show.

Asplenium salicifolium L. Sp. Pl. 1080. 1753. PLATE LV.

At Pl. LV is shown a Cuban plant, which is one of a series collected by the writer at Monte Verde, Yateras, Province of Oriente.[a] This will be seen to agree closely with plate 60 of Plumier, particularly in the following characters: (1) The relative length of stipe and lamina; (2) the narrowly ovate frond, only slightly reduced below and terminated by a lobed caudiform segment; (3) the direction, position, and shape of the numerous pinnæ, the number being nearly the same; (4) the type of marginal crenation. In this last character some slight allowance must be made for plate 60, as in the case of many others of the Plumier figures; for the plant to be placed under this name is really less regularly and more deeply crenate, even bicrenate often towards the base of the pinnæ. The outer portions of the lower pinnæ in plate 60 are, however, shown rather more correctly as obliquely serrate-crenate. It is hardly necessary to add that the venation and sori shown in plate 60 are incorrect for any West Indian species known and will probably remain so. The pinnæ, too, are rather closer than in any plant seen by the writer. Taking the plate as a whole, nevertheless, it is evident that it is of the species shown at Pl. LV, and nothing points to this more certainly than the shape of the apical portion.

The specimen figured in plate 55 measures 69 cm. in length; stipe 31 cm.; lamina 38 cm. long, 17 to 18 cm. broad. The texture is subcoriaceous.

The following additional specimens in the U. S. National Herbarium may be cited:

CUBA: Farallones of La Perla, north of Jaguey, Yateras, province of Oriente, altitude 540 to 585 meters, *Maxon* 4376.

HAITI: Ravines northwest of Marmelade, altitude 663 meters, *Nash & Taylor* 1351.

PORTO RICO: Barranquitas, *Sintenis* 2692b; Luquillo Mountains, *P. Wilson* 304.

JAMAICA: Without locality, *Jenman;* without locality, *ex herb. Bot. Dept. Jamaica.*

DOMINICA: Laudat, *Lloyd* 332.

GRENADA: *Murray & Elliott* 24.

MEXICO: District of Cordoba, State of Vera Cruz, *Finck* 46a, 142.

COLOMBIA: Santa Marta, altitude 750 meters, *H. H. Smith* 2446.

Some of these specimens are submembranaceous in texture; and several have the pinnæ widely overlapping the rachis at their upper base, as shown by Hooker,[b] but without free auricles. The Jenman plant has the pinnæ almost hastate at the superior base.

Wright's no. 848 from Cuba, cited by Hooker under *A. auriculatum*, is missing in the National Herbarium. In the Sauvalle herbarium at Havana, Cuba, this number is *Asplenium abscissum* Willd.; and in the herbarium of the New York Botanical Garden it is a mixture of *A. abscissum* and a reduced state of *A. salicifolium*. A sheet of no. 848 in the D. C. Eaton Herbarium, marked as coming from "La Perla, in crevices of rocks," comprises three plants, viz.: (1) *Asplenium abscissum* Willd., (2) *A. salicifolium* (*verum*), and (3) the reduced form here included under *A. salicifolium*. Matching this inferior state are two Cuban numbers collected by the writer, viz., 4311 which grew with 4306, and 4375 with 4376. These and certain other specimens from the West Indies and especially from Central America would probably pass for *A. hastatum* Klotzsch, a species which is certainly of the closest alliance, if indeed it should not be merged with *A. salicifolium.* The typical *A. hastatum,* well illustrated by Hooker,[a] is seen in Fendler's 144, Venezuela (herb. Gray), between which and the West Indian *A. salicifolium* there is almost every intermediate stage. It seems not unlikely that *A. salicifolium* (*verum*), *A. auriculatum* Sw., *A. semicordatum* Raddi, and less certainly *A. hastatum* Klotzsch are all referable to a single variable polymorphic species, to which must probably be added several "species" proposed by various writers, for example, the *A. bicrenatum* of Liebmann, which apparently is but the typical form of *A. salicifolium.*

---

[a] No. 4306, from humus and well-rotted logs in the humid forest, altitude about 575 meters, April 30, 1907.

[b] Sp. Fil. 3: *pl. 171.*

The following species either are closely related to *A. salicifolium* or have been confused under that name in the herbarium material examined:

Asplenium integerrimum Spreng. Acad. Caes. Leop. Nov. Act. **10**: 231. 1821.

PLATE LVI, FIGURE 2.

Asplenium salicifolium integerrimum Mett. Abhand. Senck. Nat. Gesell. **3**: 145. 1860.

The present species was described briefly from Porto Rican specimens, has since been collected in Porto Rico, and probably forms the greater part of Wright's no. 841 from Cuba. (See footnote under *A. rectangulare,* following.) It was originally described by Sprengel in these words:

> A. fronde pinnata, pinnis alternis petiolatis lanceolatis acuminatis basi cuneatis, rachi marginata, soris parallelis.
> In Portoricco ad arborum radices. *Bertier.*
> Stipes semiteres, glaber. Frons bipedalis, lanceolata. Pinnae spithameae glaberrimae, lanceolatae, acuminatae, integerrimae, margine subdiaphano.
> Cum nulla alia specie confundenda.

The following more complete description is drawn mainly from a series of specimens collected by the writer in the Yateras region of Oriente (Santiago) Province, Cuba, in the heart of the territory so thoroughly botanized by Wright:

Fronds few (2 or 3), 75 to 80 cm. long, lax, borne closely. Rhizome short-repent, with a noticeable tuft of long filiform dark brown chaff; stipe 25 to 30 cm. long, dull brownish stramineous, stout, sulcate in drying; lamina very chartaceous, 50 to 55 cm. long, simply pinnate, ovate, comprising about 8 pairs of narrow-spaced ascending subopposite to alternate pinnæ and a large terminal segment about the size of the basal pinnæ; rachis narrowly alate; pinnæ nearly of the same size and outline, the 5 or 6 lower pairs subpetiolate, 15 to 16 cm. long, 2.5 to 2.7 cm. broad, the others 2 to 3 cm. shorter, all exactly lanceolate, straight or slightly falcate, attenuate in the outer third, at the base nearly equal, the superior margin cut away to about 40°, the inferior to about 30°, the base thus strongly cuneate; margins absolutely entire throughout, hyaline; sori about 12 pairs to the pinna, equidistant or slightly nearer the midvein, 1.5 to 2 cm. long, borne at an angle of about 25° on the anterior branch of the mostly twice or thrice dichotomously forked veins; indusium firm, narrow, 1 mm. wide, persistent, recurved and inconspicuous at maturity.

A. integerrimum may have a considerable range through the West Indies. It appears not to occur in Jamaica, if one may judge from recent large collections, mainly of ferns, from that island. Fendler's no. 96 from Trinidad (G, N) may be referred here tentatively, though the narrow spreading pinnæ (mainly opposite), the more reduced upper pinnæ, and the deeply cleft terminal segment indicate a form possibly distinct.

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[a] Sp. Fil. 3: *pl. 172.*

The specimens seen by the writer are as follows:[a]

Porto Rico: Near Adjuntas, *Sintenis* 4381, determined by Kuhn as *A. salicifolium.* (G)

Cuba: Near Monte Verde, *Wright* 841 (G, 2 sheets; herb. Sauvalle). Yateras district (several localities: Santa Ana, Bella Vista, Monte Verde, La Perla, Las Gracias, etc.), Province of Oriente, altitude 420 to 625 meters, on stumps and tree trunks, *Maxon* 4196, 4223, 4269a, 4327, 4379, 4479, 4494a. (All in N) Sevilla Estate, in the Sierra Maestra west of Santiago de Cuba, Province of Oriente, altitude 900 meters, *Taylor* 456. (Y, N)

In the herbarium of the Missouri Botanical Garden there is a sheet (properly labeled *A. integerrimum*) without data, other than that it is of the Bernhardi herbarium.

The perfectly entire margins will distinguish this species at once from all excepting *A. neogranatense*, to which it must be nearly allied. See under *A. neogranatense.*

Asplenium rectangulare Maxon, sp. nov.

Frond 95 cm. long; stipe 40 cm. long, brownish, from an incomplete short-repent rhizome clothed with lanceolate attenuate brownish iridescent scales about 1.5 cm. long; lamina oblong-ovate, 55 cm. long, 25 cm. broad, comprising about 10 pairs of simple distant horizontal pinnæ and a similar large terminal segment; lowermost pinnæ subopposite, succeeding ones gradually alternate, all but the uppermost petiolate (3 to 4 mm.); lower and middle pinnæ of nearly equal size and form, 14 cm. long by 3 cm. broad, falcate, oblong-lanceolate, broadest near the base but of nearly equal width in the basal third, then tapering very gradually to a narrow acuminate upcurved apex, at the base decidedly unequal, the upper side exactly rectangular and rounded (not auriculate), the lower cut away in a straight line to an angle of 35° from the midvein; margins of the upper base crenate, of the middle and outer portions of the pinnæ irregularly and inconspicuously shallow crenate-serrate; sori 10 or 11 pairs to the pinna, 16 to 20 mm. long, narrow, nearer the midrib than the margin, borne at an angle slightly less than 30°, slightly curved, continuous on the successive anterior branches of the twice or thrice-forked veins; indusium 1 mm. broad, firm, appearing much narrower when recurved at maturity.

Type in the U. S. National Herbarium no. 50359, collected in eastern Cuba by Charles Wright (no. 841 in part),[b] in 1859 or 1860; distributed as *A. salicifolium* L. Known also from Haiti: *Nash & Taylor* 1123, from Mount Malauvre, altitude nearly 500 meters, growing on a shaded bank (Y, N).

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[a] In this as in following papers the herbaria from which specimens are cited will be indicated by letters: E, D. C. Eaton Herbarium at Yale University; G, Gray Herbarium; M, herbarium of the Missouri Botanical Garden; N, herbarium of the U. S. National Museum (U. S. National Herbarium); S, herbarium of Capt. John Donnell Smith; Y, combined herbaria at the New York Botanical Garden.

[b] In the Gray Herbarium there are two sheets of no 841, both being *A. integerrimum;* and no. 841 in the Sauvalle Herbarium at Havana, Cuba, is the same. The material which should be under this number at the D. C. Eaton Herbarium is not to be found, nor is this number in the herbarium of the New York Botanical Garden. Christ (Engler's Bot. Jahrb. **24**: 105. 1897) has listed a specimen of no. 841 as *A. vomeriforme* Hook. (Sp. Fil. **3**: 109. *pl. 162.* 1860). The plant thus referred may be either *A. salicifolium* or *A. rectangulare. A. vomeriforme* is apparently confined to Peru and seems quite distinct from either.

The present species must be closely related to the form regarded by Mettenius as typical *A. salicifolium* and figured by him,[a] presumably on a Peruvian plant, collected by Poeppig, this being the only specimen cited by him as of the typical form. Our specimens of *A. rectangulare* differ in having the pinnæ longer-stalked, broader, and with less pronounced marginal serrations. The general form of the pinnæ is exactly the same.

Asplenium integerrimum and *A. kapplerianum*, reduced to varietal rank by Mettenius, are here dealt with separately.

Asplenium obtusifolium L. Sp. Pl. 1080. 1753.[b]

? *Asplenium repandulum* Kunze, Linnæa 9: 65. 1834. (Type from Peru.)

Asplenium riparium Liebm. Dansk. Vid. Selsk. Skr. V. 1: 244. 1849. (Type from Mexico.)

Not closely related to *A. salicifolium*, but distributed under that name, is Mosen's no. 2111 from Caldas, Minas Geraes, Brazil, which must be referred to the polymorphic *A. obtusifolium* ranging through the West Indies and in larger States from Mexico to Peru and Brazil. That which Hooker considered the most typical form of the species he figured[c] as *A. riparium* Liebmann, a name first applied to Mexican specimens; but the plate is drawn, probably, from a Brazilian plant, several of which are cited; none of the Mexican and Central American specimens shows quite the same extreme development, while the Brazilian specimen above mentioned agrees exactly.

The peculiarities of the species in this broader sense are well brought out by Hooker, who places the better known dwarf mainly lobed or laciniate form as the "var. *obtusifolium*" of *A. riparium*, notwithstanding its priority of name. Hooker's opinion on the specific identity of these widely varying forms is here adopted; reluctantly, however, not only because of the inordinate breadth thus ascribed to the species, but also on account of the manifestly inappropriate name under which the extreme form must rest along with the typical West Indian form to which it is properly applicable.

The following specimens are in the U. S. National Herbarium:

I. WEST INDIAN FORM (mainly). Fronds small; pinnæ usually obtuse, sharply cuneate at the base, sometimes nearly entire,[d] with sinuate-dentate margins, or more often deeply lobed and irregularly laciniate, with sharply erose-dentate margins.

PORTO RICO: Utuado, *Sintenis* 6443, 6533.
GRENADA: *Elliott* 94.
DOMINICA: Rosalie, *Lloyd* 698.
MONTSERRAT: *Turner*.
TRINIDAD: *Fendler* 139.
COLOMBIA: Santa Marta, *H. H. Smith* 1126.

II. CONTINENTAL FORM. Fronds large (up to 60 cm. long); pinnæ larger and more numerous, nearly all auriculate and less acutely cuneate at the base, toward the apex acute or (in the Mosen specimen) attenuate, margins sinuate-dentate or irregularly serrate-dentate. (*A. riparium* Liebm.)

MEXICO: Vallée de Cordoba, State of Vera Cruz, *Bourgeau* 2014 (received as *A. repandulum* Kunze); District of Cordoba, State of Vera Cruz, *Finck* 35a.

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[a] Abhand. Senck. Nat. Gesell. 3: 144. *pl 4. f. 14*. 1860.

[b] Founded on the West Indian *Adiantum alis latioribus* of Petiver (Pter. Am. no. 117 *pl. 2. f. 14*. 1712, incorrectly cited by Linnæus as *f. 4*).

[c] Sp. Fil. 3: 119. *pl. 169*.

[d] Hook. & Grev. 2: *pl. 239*. 1831.

GUATEMALA: Pansamalá, Alta Verapaz, altitude 1140 meters, *von Türckheim* (John Donnell Smith 630); [a] near the Finca Sepacuité, Alta Verapaz, *Cook & Griggs* 58; wet forest floor between Sepacuité and Secanquim, Alta Verapaz, altitude 1,000 meters, *Maxon & Hay* 3263.

COSTA RICA: without locality, *Wercklé* (det Christ).

BRAZIL: Caldas, province of Minas Geraes, *Mosen* 2111 (two sheets; also in G); near Rio Janeiro, *Wilkes expedition*, as *A. salicifolium;* without definite locality, *Glaziou* 1771 (listed by Fée [b] as *A. salicifolium*).

A second specimen from Costa Rica (Suerre, Llanuras de Santa Clara, altitude 300 meters, *John Donnell Smith* 6885) is exactly intermediate between the two types. The Mosen specimens are the most extreme of all. Hooker's notes will be found of interest.

Asplenium oligophyllum Kaulf. Enum. Fil. 166. 1824.

A single specimen under cover of *A. salicifolium*, in the Gray Herbarium, Fendler's no. 326, from Tovar, Venezuela, accords well with Kaulfuss' description of *A. oligophyllum*, and this number is so referred by Hooker in his description of the species. The margins are correctly said to be "obscurely crenate-serrate." The broad pinnæ and numerous sori are characteristic.

Two Brazilian species, *Asplenium escragnollei* Fée [c] and *A. camptocarpum* Fée,[d] referred here by Christensen, appear from Fée's excellent illustrations entitled to recognition. The former especially seems very different and to be allied rather to the Colombian A. *ocaniense* Karst.,[e] known to the writer from a specimen collected by H. Pittier (no. 708) in the western Cordillera, State of Cauca, Colombia, December, 1905.

Asplenium neogranatense Fée, 7me Mém. 47. *pl. 14. f. 1.* 1854.

A species with a few entire pinnæ, figured by Fée, with no mention of the characters offered by rhizome and chaff. Apparently in its few sori a near ally of *A. integerrimum* Spreng., but quite remarkable, as noted by Fée, in the great length of the veins which are borne at a very acute angle to the midvein.

Asplenium austrobrasiliense (Christ) Maxon.

Asplenium salicifolium austrobrasiliense Christ, Denkschr. K. Akad. Wiss. Wien. Math.-naturw. Klasse **79**: 23. *pl. 5. f. 1. 2. pl. 8. f. 3. 4.* 1906.

A peculiar form, well illustrated by Dr. Christ and supposed by him to be common in southern Brazil. It has no near alliance with the true *salicifolium*, but is apparently allied to *A. oligophyllum*. From this it is easily distinct, obviously in its more numerous, smaller, and gradually reduced upper pinnæ which give rise to an enlarged terminal segment (instead of a conform terminal pinna), in its fewer more spaced sori, and especially in its bipinnatifid form with corresponding modification in position of sori indicated by Dr. Christ.

The original material has not been seen by the writer, to whom it is known only from specimens recently sent by Dr. Rosenstock under no. 296, these from the Serra do Mar, State of São Paulo, Brazil.

The form from Apiahy listed by Dr. Christ as true *salicifolium* is, judging from description, referable to *A. oligophyllum* Kaulf.

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[a] First determined as *Asplenium auriculatum* Sw., subsequently as *A. cultrifolium* L.

[b] Crypt. Vasc. Brés. 1: 64. 1869.

[c] Crypt. Vasc. Brés. 1: 62. *pl. 15.* 1869.

[d] Crypt. Vasc. Brés. 1: 63. *pl. 16. f. 1.* 1869.

[e] Fl. Col. 1: 173. *pl. 86.* 1861.

Asplenium kapplerianum Kunze, Linnæa **21**: 216. 1848.

The writer has seen no material to be referred to this species; yet it seems desirable to call attention to its status in order that it may be definitely placed by those who have access to the original material.

Asplenium kapplerianum was founded by Kunze on specimens collected near Para by Kappler (no. 1769). The author refers here also specimens from two additional sources, as follows:

I. Surinam plants collected by Splitgerber and described[a] by that writer under the Linnæan name *Asplenium salicifolium.* Kunze regards Splitgerber's description as excellent for his own *kapplerianum* and compares the Surinam plants with what he considers the true *salicifolium* as previously elaborated by him[b] on the basis of Peruvian plants collected by Poeppig (probably the same form figured by Mettenius as typical of *salicifolium*). But here Kunze falls into the error of selecting for his "*salicifolium,*" as already pointed out, an obscure plant from Peru; whereas the true *salicifolium* is a West Indian plant, collected in several localities by Plumier, and, as has been shown, well known from the West Indies under the name *A. auriculatum.*

II. Guiana plants, listed by John Smith[c] as *A. integerrimum,* which are not the *integerrimum* of Sprengel.

Asplenium integerrimum and *A. kapplerianum* were merged by Moore[d] who cites many specimens. From description *A kapplerianum* certainly appears to be distinct from *A. integerrimum* and rather closely related to *A. salicifolium.* Splitgerber's var. *β* is referred by Kunze[e] to *Asplenium falx* Desv.[f] which is probably a true synonym of *salicifolium.*

In conclusion it may be said that the plant figured by Mettenius as *A. salicifolium* is probably still without a name, unless it is found to be identical with *A. rectangulare* here described.

A NEW GENUS OF ASPLENIOID FERNS.

Holodictyum Maxon, gen. nov.[g] PLATE LVI, FIGURE 4.

Fronds numerous, densely cespitose upon an erect rhizome, simple, linear-lanceolate, chartaceo-membranaceous, costate; venation wholly areolate, the areoles in about 5 or 6 series on either side of the costa, free included veinlets none; costal areoles elongate, cuneate, nearly parallel to the costa, the others oblique, broader, oblong, mostly hexagonal, gradually much smaller toward the hyaline margin; sori elongate, diverging at a slight angle from the costa, confined to the outer vein of the costal areoles, one to each areole; indusium single, straight or nearly so, firm, persistent, attached along one side.

Type, *Asplenium ghiesbreghtii* Fourn.

Holodictyum differs from Asplenium and Diplazium in its pronounced hexagonal areolation, this accompanied by a complete suppression of lateral nerves. The sorus is placed uniformly upon the longest (outer) side of the costal areole; otherwise the veins of the whole frond are of equal rank; all are discontinuous in direction, adjoining only at an angle. The venation thus shows some approach to the type of Diplaziopsis; but in that genus, as in Hemidictyum, there are well-developed lateral nerves, lost in a network only toward the margin.

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[a] Tijds. Nat. Gesch. **7**: 418, 419. 1840.

[b] Linnæa **9**: 64. 1834.

[c] London Journ. Bot. **1**: 199. 1842.

[d] Ind. Fil. 138. 1859.

[e] Linnæa **21**: 216. 1848.

[f] Mém. Soc. Linn. Paris **6**: 274. 1827. See Mettenius' description (Abhand. Senck. Nat. Gesell. **3**: 145 1860) with reference to Fée's figure.

[g] The name is from Greek *ὅλος*, whole, and *δίκτυον*, a net, referring to the complete anastomosis of the veins.

Species two:

Holodictyum ghiesbreghtii (Fourn.) Maxon.

Asplenium ghiesbreghtii Fourn. Mex. Pl. 1: 111. *pl.* 5. 1872.

Described and figured from specimens collected by Ghiesbreght (no. 16) on wet rocks, Barranca de Tlacolula, Oaxaca, Mexico, 1842–43. This number is represented in the U. S. National Herbarium by a portion of a frond.

Holodictyum finckii (Baker) Maxon.

Asplenium finckii Baker, Ann. Bot. 8: 126. 1894.

Described from specimens at Kew, collected in the District of Cordoba, State of Vera Cruz, Mexico, by Hugo Finck. Represented in the U. S. National Herbarium by an incomplete frond recently received from Kew, this showing the areoles to be in five or six series, not in four as described by Mr. Baker.

Christensen has suggested that *A. finckii*, which apparently was founded by Mr. Baker without regard to the earlier *A. ghiesbreghtii*, may be identical with the latter. To this the writer is at present unwilling to assent. The type of venation in the two type specimens is the same, but the areoles of *finckii* are actually larger and relatively broader; the sori diverge from the costa at a greater angle and are shorter, those of *ghiesbreghtii* (according to Fournier) even attaining a maximum length of one inch. Yet we refer to *finckii* excellent specimens collected from shady situations among rocks in a long deep canyon near Gómez Farías, State of Tamaulipas, Mexico, altitude about 350 meters, by Dr. Edward Palmer (no. 336), April, 1907, which differ in their greater size and higher average number of series of areoles and in having the sori rather less divergent from the costa, this last character being in the direction of *ghiesbreghtii*. Whether the differences noted among the three specimens are no greater than should be accounted variations within a single species can not be determined with certainty from the material at hand; but it seems reasonable, on the strength of the characters mentioned above, to recognize for the present the two species already described.

The upper and apical portion of a normal frond of Doctor Palmer's no. 336 is shown in Pl. LVI, Fig. 4. The rhizome of the plant, though split in half, lengthwise, yet carries fifteen fronds, which must be about half the original number for the living plant. The fronds are about 40 cm. long and taper very gradually from about their middle to a long attenuate base, being narrowly winged down to the rhizome.

THE IDENTITY OF ASPLENIUM RHIZOPHYLLUM L.

Three very different elements were merged in Linnæus in 1753 under the name *Asplenium rhizophyllum*.[a] The names under which these have usually gone are: (1) *Camptosorus rhizophyllus*, applied to the fern of the eastern United States, (2) *Camptosorus sibiricus*, restricted to an Asiatic species, (3) *Fadyenia prolifera*, for a West

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[a] Not to be confused with the second *Asplenium rhizophyllum* of Linnæus (Sp. Pl. ed. 2. 1540. 1763), discussed at page 490 of the present paper.

Indian plant. The last is, however, an invalid name; and in substituting another, occasion may be taken to indicate the grounds for fixing upon the Virginian plant as the type of *Asplenium rhizophyllum* in preference to the other two elements originally included by Linnæus.

At page 1078 of the first edition of the Species Plantarum appears the following:

rhizophylla. ASPLENIUM frondibus cordato-ensiformibus indivisis: apice filiforme radicante. *Amoen. acad.* 2. *p.* 337.
Phyllitis filicifolia parva saxatilis virginiana per summitates foliorum radicosa. *Pluk. alm.* 154. *t.* 105. *f.* 3.
Phyllitis non sinuata minor, apice folii radices agente. *Sloan. jam.* 14. *hist.* 1. *p.* 71. *t.* 26. *f.* 1.
Phyllitis saxatilis virginiana per summitates foliorum prolifera. *Moris. hist.* 3. *p.* 557. *s.* 14. *t.* 1. *f.* 14.
Habitat in Jamaica, Virginia, Canada, Sibiria.

Turning to the second volume of the Amoenitates we find the twenty-ninth, by Halen, dated December 22, 1750, comprising pages 332 to 364, to be entitled "Plantae Camschatcenses Rariores" and to contain among other things a brief chapter descriptive (at least by citation) of some eleven plants of a recent Kamchatkan collection which are supposed to be identical with species known previously from North America. One of these is mentioned at page 337 as follows:

ASPLENIUM frondibus lanceolatis indivisis: apice filiformibus radicantibus. Phyllitis non sinuata minor, apice folii radices agente. *Sloan. Flor.* 14. Filicifolia Phyllitis parva saxatilis virginiana per summitates foliorum radicosa. *Pluk. alm.* 154. *t.* 105. *f.* 3. Phyllitis saxatilis virginiana, per summitates foliorum prolifera. *Moris. hist.* 3. *p.* 557. *s.* 14. *t.* 1. *f.* 14.

Although the plant in hand was from Kamchatka the citations show clearly that the Jamaican plant described and figured by Sloane and the Virginian described and figured by both Plukenet and Morrison were confused with this. The question is merely upon the restricted application of the trivial name *rhizophyllum* given later by Linnæus.

The Amoenitates description, "ASPLENIUM frondibus lanceolatis indivisis: apice filiformibus," though without much doubt drawn to cover the Kamchatkan plant particularly, must in any event apply either to this or to the Virginian, for the descriptive term "filiform" is totally inapplicable to the apices of the Jamaican species. Later, in the Species Plantarum (1753), the specific character (though credited to the Amoenitates) is so altered as to read "frondibus cordato-ensiformibus * * * ; apice filiforme * * *." Thus, to those who know the several species under discussion, it should be apparent at once that the Virginian plant is here especially meant, and that it must stand as the type of *Asplenium rhizophyllum;* for it alone, not only of the two, but of the three species, has a cordate base.

There is, moreover, in the Linnæan herbarium under the name *Asplenium rhizophyllum* a plant of *Camptosorus rhizophyllus* received from Kalm,[a] apparently held by Linnæus to be representative of his "species."

The two species of Camptosorus Link, 1835, are:

Camptosorus rhizophyllus (L.) Link, Hort. Berol. 2: 69. 1833.

Confined to the United States and Canada: from Maine and southern Quebec south to Georgia, Alabama, and Texas. A form from Iowa has been described as variety *intermedius* Arthur.[b]

Camptosorus sibiricus Rupr. Beitr. Pfl. Russ. Reich. 3: 45. 1845.

Known only from Siberia, China, and Japan.

The West Indian plant should be known as:

Fadyenia hookeri (Sweet) Maxon.

Asplenium proliferum Sw. Prod. 129. 1788, not Lam. 1786.
Aspidium proliferum Hook & Grev. Ic. Fil. 1: *pl. 96.* 1829, not R. Br. 1810.
Aspidium hookeri Sweet, Hort. Brit. ed. 2. 579. 1830, not Wall. 1829, *nomen nudum.*
Polystichum? grevillianum Presl, Tent. Pterid. 82. 1836.
Fadyenia prolifera Hook. Gen. Fil. *pl. 53. B.* 1840.
Aspidium fadyenii Mett. Fil. Hort. Lips. 95. *pl. 23. f. 13. 14.* 1856.
Fadyenia fadyenii C. Chr. Ind. Fil. 319. 1905.

In taking up Mettenius' specific name Christensen has passed by two of earlier date, either of which is available. There appears to be no reason for allowing Wallich's *nomen nudum* to invalidate the same name adequately published by Sweet the following year. But even should this be done, Presl's name would have to be taken up. The doubt expressed by Presl relates merely to the very questionable reference of this plant to the genus Polystichum, a doubt abundantly sustained some four years later by Hooker, who recognized in it a monotypic genus to which he gave the name Fadyenia. Presl's new specific term was simply a substitute for the homonym of Hooker and Greville and was placed with doubt under Polystichum.

F. hookeri is known from Jamaica, Cuba, and Porto Rico.

A NEW NAME FOR ANAXETUM.

The genus Anaxetum was based by Schott on the single species *Polypodium crassifolium* L., which was made the subject of an excellent illustration. Fée called attention to the unavailability of the name, Anaxeton having been applied previously by Gaertner to a new genus of Compositae, and elevated Presl's section Pleuridium to generic rank, expressly founding the genus on *Polypodium crassifolium*, surely in ignorance of the genus of mosses previously so named by Bridel and since generally adopted. No other name having been published in the interim the following is proposed:

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[a] D. C. Eaton in Canadian Naturalist 13: 25. 1870.

[b] J. C. Arthur in Botanical Gazette 8: 200. *pl. 3.* 1883.

Pessopteris Underw. & Maxon, nom. nov.[a]

Anaxetum Schott, Gen. Fil. *pl. 1.* 1834. Not Anaxeton Gaert. Fruct. **2**: 406. *pl. 166. f. 10.* 1791.

Pleuridium Fée, Gen. Fil. 273. 1850–52. Not Pleuridium Bridel, Mant. Musc. 10. 1819.

The type and sole species is:

Pessopteris crassifolia (L.) Underw. & Maxon.

Polypodium crassifolium L. Sp. Pl. 1083. 1753.

Anaxetum crassifolium Schott, Gen. Fil. *pl. 1.* 1834.

Pleuridium crassifolium Fée, Gen. Fil. 274. 1850–52.

Generally distributed throughout tropical America, and subject to considerable variation, several forms having been described as distinct species.

THE CUBAN SPECIES OF ADIANTOPSIS.

Three species of Adiantopsis have been known hitherto from Cuba. These are:

Adiantopsis radiata (L.) Fée, Gen. Fil. 145. 1850–52.

Adiantum radiatum L. Sp. Pl. 1094. 1753.

Not uncommon through tropical America generally.

Adiantopsis pedata (Hook.) Moore, Ind. Fil. 18. 1857.

Hypolepis pedata Hook. Sp. Fil. **2**: 73. *pl. 92.* A. 1852.

Known definitely from Jamaica and Cuba; accredited also to Peru.

Adiantopsis paupercula (Kunze) Fée, Gen. Fil. 145. 1850–52.

Adiantum pauperculum Kunze, Farnkr. **2**: 65. *pl. 127.* 1850.

Known only from Cuba and Jamaica.

To these must be added a fourth very different species:

Adiantopsis rupicola Maxon, sp. nov.

Plant rigid, 50 cm. high, fronds several, closely clustered upon an ascending woody rhizome covered with bright brown glossy linear chaff with a dark median line; stipe 20 cm. long, naked, shining, purplish brown; lamina 30 cm. long, 10 to 12 cm. broad, deltoid-lanceolate, coriaceous, glabrous except for a few whitish club-shaped glandular hairs on the under surface, bipinnate or, as to mature specimens, subtripinnate in the lower half; pinnæ subopposite, for the most part unequally deltoid-lanceolate with subhastate entire apices; basal pinnæ about 7 cm. long, 3 cm. broad at base, unequally triangular, the two lowest pairs of pinnules pinnate, the inferior twice as long as the superior; second and third pairs of pinnæ narrower, of similar but less pronounced basiscopic development, only the basal pair of pinnules again pinnate; succeeding pinnæ pinnate only (except for the pinnatifid basal pinnule), gradually pinnatifid, finally auriculate and entire, the uppermost produced to form the somewhat attenuate apex of the frond; pinnules at right angles to the secondary rachis, characteristic ones broadly elliptical to ovate, obtuse, somewhat excised at the base below, auriculate; sori numerous, marginal, terminal on the veins; indusia single (or rarely double), spaced about half their width or less, whitish, oblong to subreniform, reflexed at maturity to the plane of the frond.

Type in the U. S. National Herbarium, no. 372124, collected by William Palmer and J. H. Riley (no. 242) in crevices of partially shaded limestone cliffs, in mountains near El Guama, Province of Pinar del Rio, Cuba, March 10, 1900. Two other sheets of no. 242 show the species in less mature states, in which the branching is bipinnate and tripinnatifid only.

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[a] From Greek πεσσόν, a draughtboard (checkerboard) and πτέρις, a kind of fern, in modern use any fern.

A. rupicola is by no means closely related to any described species, though it is perhaps to be compared with *A. pedata* and *A. paupercula*. In the former species the prolongation of the lowermost pair of pinnæ into lateral branches renders the short frond ternate as to its main vascular parts, and the unusual basiscopic development of the basal pinnules of the lateral branches again gives the frond a broad pentagonal form. In *A. rupicola*, on the other hand, the frond is elongate and the comparatively slight extension of the inferior pinnules of the three or four lowermost pairs of pinnæ indicates no near relationship to *A. pedata*. In method of branching *A. rupicola* is near *A. paupercula*, but the pinnules differ essentially in shape, being of the type of *A. radiata* and *A. pedata*.

A NEW GENUS ALLIED TO VITTARIA.

The Jamaican plant described by Swartz as *Pteris angustifolia*, placed under Vittaria by Baker and taken up under this name by Diels, has been recognized by several writers as typifying a distinct genus to which the name Pteropsis has been applied. There can be no doubt that the species is a very foreign element under Vittaria; but, equally, it ought not to rest under the name Pteropsis. This last was given by Desvaux in 1827 to an odd assemblage of ten species belonging to no fewer than six genera. The first three species are now placed under Drymoglossum Presl (1836), the fourth is the plant under consideration, the fifth is *Paltonium lanceolatum*, the sixth is *Vittaria scolopendrina*, the seventh and eighth (described as new) are regarded by Christensen as problematical, the ninth and tenth are *Eschatogramme furcata*. Paltonium Presl dates from 1849; Vittaria J. E. Smith from 1793; Eschatogramme Trev. from 1851.

The original diagnosis of Pteropsis reads as follows: "Sporangia in sorum continuum immersum marginalem disposita. Involucrum nullum. Frondes simplices." In fixing upon the type for the genus it is not necessary to have recourse to a "first species rule" in any narrow sense; for, notwithstanding the diversity of types included, the preference of the author seems to be fairly indicated. The first three species are of the same type, being indeed referred by Christensen to a single species (*Drymoglossum heterophyllum*), and by their very position point out the importance they had assumed to the author. Pteropsis thus restricted is, unfortunately, quite synonymous with Drymoglossum of later date and must prevail for the several species now associated under the latter name, unless Mirbel's genus Candollea (1802) is to be fixed arbitrarily on the same type.[a]

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[a] See Underwood, A review of the genera of ferns proposed prior to 1832. Mem. Torr. Bot. Club 6: 247-283, December 1, 1899.

The following name, given by Professor Underwood and the writer some time ago to a large series of the *Pteris angustifolia* of Swartz, collected in Jamaica, is here proposed:

Ananthacorus Underw. & Maxon, gen. nov.[a]

Rhizome chaffy, creeping; fronds contiguous, exstipitate, simple, linear, entire, costate, the costa concealed; veins of unform rank, all joined in hexagonal (less commonly pentagonal) elongate areoles in 3 or 4 series on each side of and parallel to the costa, without free veins; sori slightly impressed, non-indusiate, in a continuous or subcontinuous line at the outer edge of the ultimate series of areoles, distant 1.0 to 1.5 mm. from the margin; paraphyses spatulate, flaccid.

Type, *Pteris angustifolia* Sw. Monotypic.

Ananthacorus angustifolius (Sw.) Underw. & Maxon.

Pteris angustifolia Sw. Prod. 129. 1788.
Taenitis angustifolia Spreng. Syst. Veg. 4: 42. 1827.
Pteropsis angustifolia Desv. Mém. Soc. Linn. Paris 6: 218. 1827.
Vittaria angustifolia Baker, in Mart. Fl. Bras. 1^2: 544. 1870.

The following specimens are in the U. S. National Herbarium:

JAMAICA: Mansfield and adjoining properties near Bath, altitude 300 to 500 meters, on tree trunks of humid forested slopes, *Maxon* 1794, 1805, 2392, 2423, 2431, 2446. Vicinity of Troy, altitude 600 to 660 meters, *Maxon* 2858. Above Moore Town, altitude 450 meters, *Clute* 272. Near Williamsfield, *Fredholm* 3352. Cuna Cuna Pass, *Fredholm* 3216 (as *Taenitis lanceolata*).

CUBA: Mountains north of San Diego de los Baños, Province of Pinar del Rio, on forest trees, *Palmer & Riley* 485, 513, 562. Monte Verde, Yateras, Province of Oriente, altitude 575 meters, on trunk of palm in forest, *Maxon* 4289; in the same vicinity, *Wright* 978. "Posesion de Stark," near Jaguey, Yateras, Province of Oriente, on tree trunks, altitude 450 to 525 meters, *Maxon* 4445. Forested slopes of the Finca Las Gracias, Yateras, Province of Oriente, on trunk of manaca palm, altitude about 500 meters, *Maxon* 4465. Alto Cedro, *Underwood & Earle* 1554.

SANTO DOMINGO: *Wright, Parry, & Brummell* 2A.

GRENADA: *Elliott* 68 (as *Vittaria remota*, det. J. G. Baker).

TRINIDAD: *Fendler* 116.

MEXICO: District of Cordoba, State of Vera Cruz, *Finck* 116.

GUATEMALA: Cubilquitz, Alta Verapaz, altitude 350 meters, *von Türckheim* (*J. D. S.* 8038). Banks of the Rio Polochic, below Panzos, on trunk of palm, *Maxon & Hay* 3097.

PANAMA: *Hayes* 10.

COLOMBIA: La Esmerelda, near Jamundí, Cauca Valley, altitude 1,100 meters, *Pittier* 954.

FRENCH GUIANA: Near Cayenne, on tree trunks, *Leprieur* 106.

BRAZIL: Matto Grosso, *Lindman* A. 3453.

The relationship of Ananthacorus is with Vittaria, from which it differs radically in its type of venation which is strictly areolate without lateral veins. The details of venation are shown by Presl (Tent. Pterid. *pl. 10. f. 3.*), by John Smith (Hist. Fil. *pl. 10. f. C.*), and by Hooker (Gen. Fil. *pl. 77. A.*).

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[a] The name is composed of Greek α privative, ἄνθος, flower, and ἄκορυς, in modern use the sweet flag, the fronds resembling the leaves of that plant.

MISCELLANEOUS NOTES AND CHANGES OF NAME.

Asplenium conquisitum Underw. & Maxon; Christ, Bull. Herb. Boiss. II. 7: 270. 1907.

Dr. Christ in some notes (l. c.) on this species (up to that time unpublished) listed recently four of the writer's numbers from Jamaica and Guatemala. The first of these, from Jamaica, *Maxon* 1558, represented in the U. S. National Herbarium by sheet no. 427829, may be regarded as the type.

The species was fully characterized by Jenman[a] under the name *Asplenium rutaceum* Mett. In his later studies Jenman recognized the plant as distinct from *rutaceum* but unfortunately assigned to it in the herbarium a specific name already preoccupied in this genus. Dr. Christ has indicated the main distinctive characters.

The following specimens are in the U. S. National Herbarium:

JAMAICA: Moist woods near the Mabess River, altitude 900 meters, *Maxon* 1558 (type); rocky bank in humid forest, vicinity of Morces Gap, altitude 1,500 meters, *Maxon* 2761; between Morces Gap and Vinegar Hill, *Underwood* 1377.

GUATEMALA: Tree trunks in humid forest, on the trail between Sepacuité and Secanquim, Alta Verapaz, altitude 1,000 meters, *Maxon & Hay* 3257; on a stump in humid forest, on the trail from Senahú to Actalá, Alta Verapaz, *Maxon & Hay* 3310.

Diplazium oreophilum Underw. & Maxon, nom. nov.

Asplenium franconis Jenman, Bull. Bot. Dept. Jamaica II. 1: 91. 1894. Not *Diplazium franconis* Liebm. Dansk. Vid. Selsk. Skr. V. 1: 256. 1849.

The type of *Diplazium franconis* is from Oaxaca, Mexico. As illustrative may be cited the following Guatemalan specimens in the National Herbarium: *John Donnell Smith's* no. 636, collected at San Pedro Carchá, Depart. Alta Verapaz, altitude 1,150 meters, by von Türckheim, June, 1885; and *Maxon & Hay* no. 3324, collected in Alta Verapaz, along the trail between Senahú and Actalá, January 17, 1905. These agree closely with the original collection of Liebmann as represented by a fragment in the herbarium of the New York Botanical Garden.

Compared with these the Jamaican plant is readily seen to be distinct. The fronds are broadly triangular ovate, tripinnate or even quadripinnatifid, the pinnæ ordinarily 20 to 25 cm. long[b] and 10 to 13 cm. broad, the pinnules 6 to 7 cm. long, lanceolate, stipitate (0.5 cm. in the largest), acuminate. The larger pinnules comprise about 8 pairs of oblong or ovate-oblong obtuse segments, of which the lowermost are free, deeply lobed and almost comparable to the *pinnules* of the much simpler *D. franconis*. The contrast with *D. franconis* in size, form, and degree of subdivision is too pronounced to require more detailed comparison.

D. oreophilum is not infrequent in humid depressions nearly up to 900 meters in the Blue mountains of Jamaica and is oftenest met with in a sterile condition. Ordinarily it is found fertile only in the vicinity of forest openings, and in such cases there is to be noted a marked dimorphic tendency, the sori (if present at all) being borne very closely and in great profusion, with a corresponding reduction of leaf tissue. It is apparently confined to Jamaica. Jenman's specimens (the types) are at the New York Botanical Garden. The following are in the National Herbarium: *Maxon* 1178, 2483, 2376; *Clute* 276; *Moore;* and one from the Botanical Department of Jamaica.

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[a] Bull. Bot. Dept. Jamaica II. 1: 62. 1894.

[b] According to Jenman even 35 cm. long.

Dryopteris oligophylla Maxon, nom. nov.

Polypodium invisum Sw. Prod. 133. 1788, not Forst. 1786.

Nephrodium sloanei Baker in Hook. & Baker, Syn. Fil. ed. 2. 263. 1874, not Presl, 1825.

Dryopteris sloanei Kuntze, Rev. Gen. Pl. **2**: 813. 1891.

Nephrodium invisum Desv. Mém. Soc. Linn. Paris **6**: 257. 1827.

The above synonymy, if complete as to specific names, indicates the need of a new name for this common tropical American fern. Swartz followed his brief but excellent first description with a reference to Sloane's plate 51, illustrating a Jamaican specimen. This is unmistakably the plant known of late years as *Dryopteris* (or *Nephrodium*) *sloanei* and best described by Jenman.[a] Why Christensen should have relegated it to subspecific rank and that under *Dryopteris patens* is not clear; for its specific distinctness is evident, and in any case the alliance is with *Dryopteris serra*, as Jenman pointed out. The latter's remarks on its occurrence in Jamaica are otherwise of interest: "Common among the lower hills and widely spread through the country, ascending to 5,500 ft. altitude, on banks and other open places. A very fine species, the fronds however not erect but arching from the base outwards. A much wider-pinnaed plant than *Serra*, to which it is closely allied. The texture is rather thin but hard, becoming rigid when dry. The rootstock is very wide-creeping under the surface of the ground, with the stipites scattered along it. Frequently the fructification does not reach the outer of the pinnæ."

The following collections are in the National Herbarium:

JAMAICA: Elevations mainly of 600 meters or less, *Maxon* 995, 1003, 1777, 1781, 1859, 1935, 1991, 2379, 2527, 2823; *Underwood* 104, 3249, 3301; *Clute* 131; *Harris* 8962; *Jenman*.

CUBA: *Wright* 3922; *Maxon* 3920.

PORTO RICO: *Heller* 6345; *Underwood & Griggs* 75, 762; *Sintenis* 2636.

ST. KITTS: *Britton & Cowell* 483.

HAITI: *Picarda* 1030.

COSTA RICA: *J. D. Smith* 6901; *Pittier* 20964; *Wercklé* (as *Aspidium macrourum*).

COLOMBIA: *H. H. Smith* 2454.

Nephrodium paucijugum Jenman is referred to by Jenman (*l. c.*) as possibly a young state of the present species. Under this name in the Jenman herbarium at the New York Botanical Garden are two immature sterile plants on separate sheets. One of these, with creeping rhizome and *serrate* segments, agrees well with the original description of *paucijugum* and is undoubtedly the type; it is too young to refer with certainty to any described species, but it is positively not *sloanei* (*i. e. oligophylla*). The second is a different species, with *entire* segments and long-attenuate pinnæ; it also is young, but apparently a young state of *sloanei* (*i. e. oligophylla*). Jenman's erroneous association of this second specimen with his type of *paucijugum* explains satisfactorily his later suggestion that *paucijugum* might be a young state of *sloanei*. *Nephrodium paucijugum* itself, properly restricted to the original, must for the present be kept among the *species inquirendae*.

Dryopteris pyramidata (Fée) Maxon.

Goniopteris pyramidata Fée, 11me Mém. 61. *pl. 16. f. 2.* 1866.

This little known species was founded on a plant collected in Gaudeloupe by L'Herminier in 1861. No. 50240 in the U. S. National Herbarium, collected in Santo Domingo by Wright, Parry, and Brummel (no. 12) in 1871 is apparently the same. It is a true Dryopteris (§ Eudryopteris of Christensen) and is by no means to be confused with any form of *D. tetragona*, which is of the section Goniopteris. Fée's detail figure almost certainly represents one of the lowermost pinnæ, probably the lowest or next to the lowest; at least in the specimen at hand only the two or three lowermost pairs of pinnæ are contracted at the base, as shown in the figure. See under *D. johnstoni*, page 498, and under *D. latiuscula*, page 498.

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[a] Bull. Bot. Dept. Jamaica II. 3: 164, 165. 1896.

Dryopteris radicans (L.) Maxon.

Asplenium radicans L. Syst. Nat. ed. 10. 2: 1323. 1759.
Asplenium rhizophyllum L. Sp. Pl. ed. 2. 1540. 1763. Not *Asplenium rhizophyllum* L. Sp. Pl. ed. 1. 1078. 1753; Sp. Pl. ed. 2. 1536. 1763.
Asplenium rhizophorum L. Gen. Fil. ed. 6. (emendation, at end). 1764.
Polypodium repens Sw. Prod. 132. 1788. Not Sw. Prod. 130. 1788, which is *Campyloneurum repens*.
Polypodium reptans Gmelin, Syst. Nat. 2^2: 1309. 1791.
Goniopteris reptans Presl, Tent. Pterid. 182. 1836.
Phegopteris reptans D. C. Eaton, Bull. Torr. Club 10: 101. 1883.
Nephrodium reptans Diels in Engl. & Prantl, Nat. Pfl. 1^4: 168. 1899.
Dryopteris reptans C. Chr. Ind. Fil. 288. 1905.

The *Asplenium radicans* of Linnæus (1759) was founded directly upon Sloane's plate 29 and plate 30, figure 1, representing Jamaican plants, and upon Plukenet's plate 253, figure 4.

The *Asplenium rhizophyllum* published in the second edition of the Species Plantarum (page 1540) was founded on the identical plates cited under *Asplenium radicans*, with the addition of a reference to Browne's "*Asplenium simplex minus reflectens*, etc.," this in turn having been established partly (or perhaps wholly) on the Sloane and Plukenet figures cited under *radicans* and *rhizophyllum*.

Asplenium rhizophorum L., 1764, is merely a change of name for *rhizophyllum* of the second edition, page 1540; not *rhizophyllum* of the first edition, page 1078, and of the second edition, page 1536, which is *Camptosorus rhizophyllus*.

The three names are thus identical in application, having to do with the same plates; and the earliest is *radicans*, 1759.

The plates cited represent a species of Dryopteris,—a common and well known tropical American fern usually called *Dryopteris* (or *Nephrodium*) *reptans*. The figures are unmistakable, Sloane's plate 29 in particular representing a characteristic form of the typical Jamaican plant. Sloane's description is not less distinctive.

Notwithstanding this, later writers have apparently without exception substituted under one or another of the Linnæan names (usually *rhizophorum*) a plant of another genus, namely a true Asplenium with glossy stiff purplish brown stipes and rachis, a plant like the original only in its wide range of variation and in having a radicant tip. Swartz, in his Observationes Botanicae,[a] seems to have been responsible for formally introducing or at least sanctioning this substitution, by noting (under *A. rhizophorum*) that Sloane's plate 30, figure 1, should be referred to his own *Polypodium repens* which had been published in 1788, founded on this same plate 30, figure 1, and Plukenet's plate 253, figure 4. "*Asplenium rhizophorum*" was held by him to be bipinnate, in mature plants, a character here introduced for the first time. Because of his *P. repens* of page 130 (1788) (this is *Camplyoneurum repens*) the *P. repens* of page 132 becomes *P. reptans* in the Synopsis Filicum (1806), a name given first by Gmelin (1791) who cited Sloane's plate 30, figure 1; and under this last name Swartz cites both plate 29 and plate 30, figure 1,[a] the prototypes of the Linnæan *Asplenium radicans*, 1759.

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[a] Page 399. 1791.

By 1806, then, the transfer of the Jamaican plants from the several Linnæan names under Asplenium had become complete. The confusion could have been avoided by a slight regard for the Linnæan citations.

Sloane's long description[b] is well worth perusal. His specimens in the herbarium of the British Museum were determined as *Polypodium reptans* by Jenman[c] who cites plate 29 and plate 30, figure 1, adding, "Sloane well describes the great variation of form in this species, and says that he had 'not seen in any Plant so great sporting of nature.'"

If there is the slightest evidence that any true Asplenium formed a part of the original *Asplenium radicans* L., 1759, *A. rhizophyllum* L., p. 1540, 1763, or *A. rhizophorum* L., 1764, it is unknown to the writer. The Asplenium commonly listed under these names (usually under the last) ranges from simply pinnate to tripinnate and appears to have first received a tenable name at the hands of Richard as *Asplenium cirrhatum*,[d] on specimens from Gaudeloupe. These were simply pinnate. Between this state and the most compound there is every intermediate stage, as shown alone by the Jamaican series in the U. S. National Herbarium. The figures given by Hooker show some of these,[e] but all of Hooker's synonyms are not to be credited. *A. cirrhatum* is especially common in the West Indies and occurs less frequently on the continent. In its various forms it has received many names; several of these have recently been reapplied by Urban.[f]

Dryopteris serrulata (Sw.) C. Chr. Ind. Fil. 292. 1905.

Polypodium serrulatum Sw. Schrad. Journ. Bot. **1800**^{2}: 25. 1801, not Mett. 1856.

Polypodium asplenioides Sw. Schrad. Journ. Bot. **1800**^{2}: 26. 1801.

? *Polypodium lunanianum* Hew. Mag. Nat. Hist. II. **2**: 460. 1838.

Nephrodium serrulatum Jenman, Bull. Bot. Dept. Jamaica II. **3**: 189. 1896.

The three names here involved were all given originally to Jamaican plants. *Polypodium serrulatum* Sw. was founded upon Sloane's plate 43, figure 1, representing a plant of which Sloane says: "It grows on Mount Diablo, near Archers Ridge, and other inland woody parts of the Island."

Polypodium asplenioides Sw. was founded on Sloane's plate 43, figure 2, this showing a plant upon which Sloane comments at length, in part as follows: "This is in everything the same as the former, only, although as high, yet 'tis in everything lesser, the *Pinnae* a little more frequent, shorter and narrower by much than that immediately preceding, being not over half an Inch broad at Base where broadest, ending in a point. And in this, which seems to be quite different from the former, there are some varieties. It grew with the former."

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[a] Also Plukenet, *pl. 286, fig. 2*, which had been cited by Poiret (Encyc. 5: 530. 1804) under *Polypodium radicans*. Poiret's use of the term *radicans* is apparently independent of Linnæus, 1759; and *Polypodium radicans* Poiret is a doubtful synonym of *Dryopteris radicans*. The *Polypodium rhizophyllum* Sw. cited by him as a doubtful synonym is, of course, *Polystichum rhizophyllum* (Sw.) Presl.

[b] Page 77.

[c] Journ. Bot. **24**: 34. 1886.

[d] Willd. Sp. Pl. **5**: 321. 1810.

[e] Sp. Fil. **3**: *pl. 187.* 1860, as *A. rhizophorum.*

[f] Symb. Antill. **4**: 35. 1903.

In the early part of May, 1903, and again during the latter part of the same month in 1904, the writer spent several days in the vicinity of Mount Diablo, on both occasions staying at Hollymount (altitude about 750 meters) by kind permission of the owner of this beautiful estate, W. P. Purdon, Esq., of Kingston. Among the extensive collections made there is a series of specimens including the connecting forms between the extremes shown by Sloane in the two figures cited above; having regard for which there is no alternative but to combine all under a single name. This is the conclusion at which Jenman arrived in his later work, and he published a good description of the species in this broad sense in 1896 under the name *Nephrodium serrulatum* Jenm. (*l. c.*). Oddly enough, however, he yet made use of the Swartzian name *asplenioides* for quite a foreign group of plants, describing[a] under the name *Nephrodium asplenioides* Baker several different forms, of which at least a part are associable with *Dryopteris radicans* (L.) Maxon of the present paper (p. 490). That Jenman should follow Baker in misapplying the name *asplenioides* is rather remarkable, in view of his having examined Sloane's specimens in the British Museum[b] and his having drawn a proper diagnosis of the species under the name *Nephrodium serrulatum* Jenm. (*l. c.*), which description certainly includes the original *asplenioides* of Swartz.

The reference of *Polypodium lunanianum* Heward to *D. serrulata* is, from description, doubtful.

The true *D. serrulata* is apparently confined to Jamaica. The following specimens, showing a very wide degree of variation, as described by Jenman, are in the U. S. National Herbarium:

JAMAICA: Vicinity of Hollymount, Mount Diablo, altitude about 750 meters, *Maxon* 1878, 1890, 1893, 1908, 1923, 1925, 1952; *Underwood* 1890. Hartford and adjoining properties, near Priestmans River, altitude 75 to 300 meters, *Maxon* 2514. Vicinity of Mandeville, *Maxon* 2571.

Goniophlebium ampliatum Maxon, nom. nov.

Polypodium gladiatum Kunze, Linnæa **9**: 45. 1834, not Vell. 1827.

It has been customary to refer *P. gladiatum* Kunze, founded upon specimens collected in the interior of Cuba by Poeppig, to *Polypodium* (*Goniophlebium*) *attenuatum* H. & B., 1810, the latter a rather uncommon species described originally from plants collected in Venezuela and Brazil with mention of Schkuhr's plate 14, representing Guiana specimens. The Cuban plant, however, seems to differ constantly in the shape of the pinnæ, these very long attenuate and falcate, narrowed at the base and even subpetiolate, the lower and middle ones essentially free and only the uppermost adnate or slightly decurrent, and in the more numerous deeply impressed or pustulate sori commonly borne in four rows. The margins also are conspicuously undulate, especially in the fertile fronds. The following specimens, which agree with a portion of the type collection in the herbarium of the New York Botanical Garden, show no more than a normal amount of variation.

CUBA:

PROVINCE OF ORIENTE: Near Monte Verde, *Wright* 804, *Maxon* 4301; Santa Ana, 6 miles north of Jaguey, *Maxon* 4133, 4207; vicinity of Baracoa, *Pollard, Palmer, & Palmer* 64.

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[a] Bull. Bot. Dept. Jamaica II. **3**: 211, 212. 1896.

[b] The Sloane specimens were reported on by Jenman in 1886 (Journ. Bot. **24**: 36). At that time he was inclined to regard the two extreme forms as possibly representing two distinct species; from this position he later receded, as stated.

PROVINCE OF PINAR DEL RIO: Near Pinar del Rio, *Palmer & Riley* 41, 83; *Shafer* 388; in mountains north of San Diego de los Baños, *Palmer & Riley* 510, 571; Los Palacios, *Van Hermann* 3291.

PROVINCE OF MATANZAS: Vicinity of Madruga, *Britton*, *Britton & Shafer* 695.

ISLE OF PINES: *A. A. Taylor* 9.

JAMAICA:

Mount Hermon, near Chepstow, *Moore*.

Phymatodes nematorhizon (D. C. Eaton) Underw. in herb.

Polypodium nematorhizon D. C. Eaton, Bot. Gaz. **3**: 90. 1878.

This rare species, founded on Fendler's no. 73, from Trinidad, and known hitherto only from that island, has recently been collected on the island of Margarita, Venezuela, by Mr. J. R. Johnston (no. 147) at an altitude of 500 meters. The specimens, which agree perfectly with the types, were distributed as *Polypodium lanceolatum* L.

Polypodium kalbreyeri Baker, Timehri II. **5**: 215. 1886; Trans. Linn. Soc. II. Bot. **2**: 291. 1887.

Polypodium longipes Fée, Crypt. Vasc. Brés. **2**: 53. *pl.* *95. f. 3.* 1872–73, not Link, 1850.

Polypodium transiens Lindm. Ark. Bot. **1**: 235. *pl. 11. f.* 7. 1903.

The type of Fée's *P. longipes* was from Brazil (*Glaziou* 4414). Dr. Lindman refers here also Mosen's no. 3535, redescribing the species under a new name (*P. transiens*) supposed to be necessary on account of Fée's homonyn. Guiana specimens in the Jenman herbarium at New York, however, show that Baker's *P. kalbreyeri*, founded in the interim on specimens from Guiana and New Granada, is the same.

Dr. Christ has reported[a] the species recently from Costa Rica on one of Wercklé's specimens without definite locality, and the following specimen collected by the writer also agrees perfectly with the South American material: On tree trunks, vicinity of La Palma, Costa Rica, altitude 1450–1550 meters, May 1906, *Maxon* 466.

Polystichum solitarium (Maxon) Underw. in herb.

Polystichum munitum solitarium Maxon, Fern Bull. **11**: 39. 1903.

Professor Underwood was strongly of the opinion that this form from Guadelupe Island off the coast of Lower California is worthy of specific rank, on the strength of the characters pointed out in the original description. No additional specimens have been seen and the species is apparently confined to Guadelupe Island. It is allied also to *P. falcinellum* of Madeira.

Tectaria martinicensis (Spreng.) Maxon.

Aspidium martinicense Spreng. Anleit. Kennt. Gewächse ed. 1. **3**: 133. 1804.

Aspidium macrophyllum Sw. Syn. Fil. 43, 239. 1806.

Sagenia macrophylla Moore, Ind. Fil. xxxvi. 1857.

Nephrodium macrophyllum Baker, in Hook. & Baker, Syn. Fil. 300. 1867.

Common in the West Indies; apparently less so in Central and South America. Sprengel cites Plumier's excellent plate 145 as does also Swartz, who accredits the name to "Rudolphi, Bemerk. e Reise 2 p. 103. (Note)", a work unknown to the writer.

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[a] Bull. Herb. Boiss. II. **4**: 1103. 1904, as *P. longipes*.

Tectaria plantaginea (Jacq.) Maxon.

Polypodium plantagineum Jacq. Coll. Bot. 2: 104. *pl. 3. f. 1.* 1788.
Aspidium plantagineum Griseb. Abh. Kön. Gesell. Wiss. Gött. 7: 286. 1857.
Dryomenis plantaginea J. Sm. Bot. Voy. Herald 229. 1854.
Podopeltis plantaginea Fée, Gen. Fil. 9. 1850–52.
Bathmium plantagineum Fourn. Bull. Soc. Bot. France 19: 254. 1872.

Appears to differ from the more typical species of Tectaria only in its simple fronds. There are several well marked forms which possibly deserve to rank as distinct species.

Tectaria purdiaei (Jenman) Maxon.

Aspidium purdiaei Jenman, Gard. Chron. III. 22: 282. 1897.
Nephrodium sherringiae Jenman, Journ. Bot. 25: 99. 1887. Not *Nephrodium sherringii* Jenman, 1879.
Aspidium psammisorum C. Chr. Ind. Fil. 89. 1905.

To this species may be referred Miller and Johnston's no. 158 and Johnston's no. 173, both from Margarita Island, Venezuela. The relationship is clearly with *Tectaria martinicensis.* The types of both *Aspidium purdiaei* and *Nephrodium sherringiae* were from Trinidad. *A. psammisorum* was proposed as a change of name for the latter.

NEW SPECIES IN SEVERAL GENERA.

Asplenium sarcodes Maxon, sp. nov. PLATE LVI, FIGURE 3.

Fronds numerous, 12 to 15, borne in a perfect crown; rhizome (mostly subterranean) succulent, erect, 10 cm. and more high (incomplete), about 3 cm. in diameter, at the exposed apex very thickly clothed with narrowly triangular long-attenuate slightly lustrous "mummy brown" scales, 8 to 10 mm. long, the margins entire or by rupture slightly lacerate; stipe stout, 20 cm. long, sulcate and dark greenish brown in drying, toward the base beset with very narrow brownish scales; lamina oblong, 40 cm. long, at the middle 15 to 16 cm. broad, somewhat reduced below: rachis similar to the stipe but narrowly alate, flattened (in drying); pinnæ coriaceous (carnose in the living plant), opaque, about 14 pairs, opposite or subopposite, the lowermost pair borne at an angle of about 45° and distant 5 cm. from the second, middle ones divergent at a greater angle and about 2 cm. apart, upper ones gradually smaller but not greatly reduced, giving rise abruptly to a petiolate terminal pinna of similar form; characteristic middle pinnæ 9 cm. long, 1.8 cm. broad, nearly straight (sometimes either falcate or slightly decurved), lanceolate, petiolate, at the base unequal, rounded truncate on the superior side, deeply excised below, the margins lightly, irregularly, and obliquely crenate, more deeply crenate-serrate toward the acute apex; under surface (as well as the rachis) sparsely covered with deciduous tortuose skeleton-like dark brown scales, these filiform from a broad substellate base; veins concealed, emerging at an angle of about 45°, curved, the basal ones 2 or 3 times forked, the others mostly once forked; sori about 16 to 18 pairs, nearer the costa than the margin, borne on the anterior branch at or near its point of origin: indusia firm, whitish, broadly elliptical, 4.5 to 5.5 mm. long, 1.5 to 1.75 mm. broad; sporangia cinnamon-brown, long-pedicellate, naked.

Type in the U. S. National Herbarium, no. 523133, collected at edge of rocky forest near the summit of the Farallones of La Perla, north of Jaguey, Yateras, province of Oriente, Cuba, altitude about 585 meters, by William R. Maxon (no. 4390), May 2, 1907.

The following additional specimens may be cited:

CUBA: Near Monte Verde, January to July, 1859, *Wright* 845 (E): "Summit of Nimanima, on rocks," 1856–1857, *Wright* 845 (E); without definite locality, *Wright* 845 (Y); fragment, *Wright* 845 (N).[a] Santa Ana, about 6 miles north of Jaguey, Yateras, province of Oriente, altitude 600 to 625 meters, *Maxon* 4195. Near summit of Gran Piedra, province of Oriente, altitude about 1,150 meters, *Maxon* 4051.

PORTO RICO: Yauco, 1880, *Garber* 96 (E).[b]

Linden's no. 1887, from Cuba, and Sintenis' nos. 2692, 4234b, and 6459, from Porto Rico, cited by Hooker and by Urban, respectively, as *A. anisophyllum*, probably belong here; as does also Linden's 1890 cited by Fée[c] under this name, without comment, along with Linden's 1887.

A. sarcodes is allied to *A. anisophyllum* Kunze[d] and *A. sanguinolentum* Kunze, the former an African species, the latter South American. *A. anisophyllum*, as shown by two complete specimens out of the series at hand, has the rhizome erect (as in *A. sarcodes*), not creeping, as redescribed by Mettenius[e], whose description is otherwise excellent. It differs from *A. sarcodes* in its firm light-colored subterete stipe and rachis (these could hardly have been carnose, as in *A. sarcodes*), in its delicate membranous texture and apparent venation, and in having the margins deeply serrate (instead of lightly crenate). The fronds are considerably larger and terminate much less abruptly than in *A. sarcodes;* they are also sometimes proliferous.

A. sanguinolentum Kunze,[f] in the typical form figured by Mettenius,[f] is known to the writer only from Regnell's III 1468, from Caldas, province of Minas Geraes, Brazil (N). H. H. Smith's no. 1128 from Santa Marta, Colombia, altitude about 1,650 meters (N) is similar to this in delicate texture and marginal serration, but has the superior base of the pinnæ less auriculate and scarcely excised at the inner margin. Both specimens have the rachis dark and compressed, as in *A. sarcodes*. They approach *A. sarcodes* only through Wright's Monte Verde specimen, which is the most extreme of those cited under *sarcodes* and which has the pinnæ of more delicate texture and more deeply crenate-serrate than the others. None of the Cuban and Porto Rican plants have the pinnæ auriculate or even subauriculate or excised at the inner margin.

A. sarcodes is thus nearest related to the continental *A. sanguinolentum*, being distinguished ordinarily by its very coriaceous texture, by having the pinnæ rounded-truncate at the superior base (even slightly overlapping the rachis in some specimens), by its lightly crenate margins, and by its concealed venation.

Cheilanthes aemula Maxon, sp. nov.

Fronds about 50 cm. high, clustered; rhizome short-creeping, thickly covered with narrow ferruginous chaff; stipe 22 to 25 cm. long, stout (2 to 2.5 mm. thick), more or less flexuose, blackish or dark purplish brown, rigid, terete; lamina subcoriaceous, 30 to 35 cm. long, 20 to 22 cm. broad at base, broadly triangular, very deeply quadripinnatifid below, otherwise tripinnate nearly throughout; primary rachis similar to the stipe, its upper surface and that of the secondary rachis covered with a scurfy jointed pubescence;

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[a] *Wright* 845 was reported first by Eaton (Am. Journ. Sci. II. **27**: 199. 1859) as "Asplenium, salicifolio, *L.* affine," subsequently (Mem. Am. Acad. II. **8**: 205. 1860) as *A. anisophyllum* Kunze. It is cited under the last name by Hooker (Sp. Fil **3**: 112. 1860).

[b] Listed by Urban (Symb. Antill. **4**: 35. 1903) as *A. anisophyllum* Kunze.

[c] Hist. Foug. Antill. 34. 1866.

[d] Linnæa **10**: 511. 1836.

[e] Abh. Senck. Nat. Gesell. **3**: 143. *pl. 4. f. 12.* 1860.

[f] Kunze; Mett. Abh. Senck. Nat. Gesell. **3**: 142. *pl. 4. f. 10.* 1860.

pinnæ 12 to 14 pairs, the lowermost nearly or quite opposite and distant, middle ones ovate, approximate and mostly alternate, apex of the frond short; basal pinnæ very unequally and broadly triangular, 11 to 13 cm. long, 5 to 6 cm. broad at base, the first inferior pinnule 4 to 4.5 cm. long and 2 to 3 cm. distant from the main rachis, the first superior pinnule 1.5 to 2 cm. long and 1 to 1.75 cm. distant from the main rachis; pinnules triangular-ovate, those of the lowermost pairs of pinnæ relatively narrower with 6 to 9 pairs of approximate narrowly ovate pinnulæ and a subentire acute terminal segment, only the 3 or 4 larger pairs of pinnulæ of the lower pinnules again pinnatifid into small ovate segments; under surface glabrate, with a few yellowish hairs; sori confluent, continuous or occasionally interrupted by a shallow indentation; indusia narrow, membranous.

Type in the U. S. National Herbarium, no. 572224, this being one of several sheets of Dr. Edward Palmer's no. 187, collected at Victoria, State of Tamaulipas, Mexico, in a river canyon, under overhanging rocks, altitude about 320 meters, February 1 to April 9, 1907. Doctor Palmer's no. 563 and no. 564 with identical data are the same. Young semifertile or sterile plants differ in having the fronds almost ternate or subpentagonal, and the final segments obtuse or even rounded; in the last particular considerable variation is to be noted also in mature specimens.

Cheilanthes aemula is allied to *C. microphylla*, with which indeed it grew at the type locality; but from that species it differs notably in its broadly triangular fronds and far greater subdivision.

Additional specimens to be referred here are, as represented in the National Herbarium, Dr. C. G. Pringle's 1988 (distributed as *C. microphylla*), from shaded banks near Monterey, State of Nuevo Leon, Mexico, June 20, 1888; and Doctor Palmer's no. 1413 of his 1880 collection from some part of Coahuila or Nuevo Leon.

Cheilanthes peninsularis Maxon, sp. nov.

Plant 15 to 17 cm. high, the fronds borne closely; rhizome short-creeping, branching, with compact covering of minute acicular brownish-striped scales, those of the growing point tawny and long-attenuate; stipe 7 to 10 cm. long, very slender (about 5 mm. in diameter), dark purplish brown, sparsely covered with very slender (mostly filiform) tortuose shrunken yellowish brown scales, mostly appressed and inconspicuous; lamina 6 to 8.5 cm. long, 4 to 5 cm. broad, narrowly ovate, clear bright green, deeply tripinnatifid, membranaceous; primary and secondary rachises bearing chaff similar in texture and color to that of the stipe but mostly broader, especially that of the secondary rachis which is linear-lanceolate, attenuate, tapering from the base, more or less erose; pinnæ about 6 pairs, the lowermost subopposite, with lower basal pinnules somewhat produced, 3 to 3.7 cm. long, subtriangular-ovate, 2 to 2.5 cm. distant from the next pair above, these oblong-ovate; the remaining pinnæ spaced, not overlapping, alternate; in general, the larger pinnæ deeply bipinnatifid, with about 6 pairs of spaced alternate oblong-ovate pinnules, these obliquely and deeply divided into 4 or 5 pairs of alternate ligulate-cuneate lobes connected by a flexuose wing of nearly equal width, the larger lobes again once or several times cleft toward the apex; sori terminal on the solitary veins of the ultimate lobes; indusia formed by the slightly modified inflexed margins.

Type in the U. S. National Herbarium, no. 397942, collected by T. S. Brandegee in the Cape region of Lower California, Mexico, November, 1902. There are in addition two sheets from San José del Cabo, that is to say, the same region, also collected by Mr. Brandegee, September 10, 1890. All were distributed as *Cheilanthes pringlei*, a nearly allied species described originally from Arizona and since found to range into northwestern Mexico. From *C. pringlei*, however, the new species may be distinguished by the following obvious characters: (1) The slender purplish brown stipes, with fewer narrower scales (not stout reddish brown stipes with copious chaff), (2) fronds narrowly ovate (not short, triangular or deltoid-ovate), (3) pinnæ spaced (not close-set and overlapping), (4) primary and secondary rachises with sparse narrow yellowish brown scales (not with very numerous broad whitish scales extending thickly even to the vascular parts of the pinnules and commonly obscuring the under surface). The last character is in itself sufficient to indicate the distinctness of *C. peninsularis*, though the difference in shape of fronds is almost equally pronounced.

Diplazium delitescens Maxon, sp. nov. PLATE LVI, FIGURE 1.

Rhizome creeping horizontally, 2.5 cm. long (incomplete), about 3 mm. in diameter, covered thickly with distichous stipe-bases; scales of rhizome perhaps somewhat abraded, inconspicuous, minute, very dark, coarsely reticulated, brittle, elongate-triangular, acuminate, closely appressed; fronds borne singly, distichous by succession, 43 cm. long, arcuate; stipe 21.5 cm. long, at the base thickly clothed with brownish lanose hairs intermixed with a few scales like those of the rhizome, conspicuously flattened laterally, the anterior face concave, the posterior convex, thus in section narrowly hippocrepiform, vascular bundles two; lamina 21.5 cm. long, about 20 cm. broad at the base, broadly deltoid-ovate; pinnæ about 7 pairs, firm, membranaceous, the lowermost the largest, subopposite, 11 cm. long, 2 cm. broad, short-petiolate, patent, attenuate, succeeding pinnæ slightly smaller, ascending, adnate, the uppermost 1 or 2 pairs abruptly reduced, rounded or even retuse at the apex, giving rise to a subhastate, caudate terminal segment (about 8 cm. long), this shallowly lobed below, toward the apex obliquely serrate; characteristic pinnæ lanceolate, straight or slightly falcate, broadest near or below the middle, attenuate (casually elongate), at the base unequally cuneate-truncate (below narrowly cuneate, above subtruncate), the inner margin straight and nearly parallel to the rachis, subauriculate, margins elsewhere regularly curvescent-serrate; midveins prominent nearly throughout on the lower side, the veins mostly apparent, 3 or 4 times forked; sori elongate, 7 to 9 mm. long, narrow, slightly curved, uniserial, nearer the midvein than the margin, borne on the first anterior (simple) branch; indusia narrow, firm.

Type in the U. S. National Herbarium, no. 403261, collected in the vicinity of San Luis, Province of Oriente, Cuba, by Charles L. Pollard and William Palmer (no. 348), February, 1902.

To be referred here also are the following:

HONDURAS: San Pedro Sula, Department of Santa Bárbara, altitude 300 meters, *C. Thieme* (distributed by John Donnell Smith, under no. 5675, as *Asplenium cultrifolium*). (N)

PANAMA: *S. Hayes* 57. (N)

A most distinct species, especially remarkable for its peculiar marginal cutting which is best described as curvescent-serrate, a term used recently by Professor Burgess. The form of the pinnæ also is uncommonly characteristic and quite unlike that of any of the smaller American species of Diplazium. The type specimen shows only an occasional diplazioid sorus; but the Honduras specimen cited has the sori more numerous, freely diplazioid, and extending rather closer to the margin.

A. cultrifolium L., which Christensen is probably correct in considering a Diplazium, was founded on Plumier's plate 59, supposed to represent a plant from Martinique. It is, on this basis, a species unknown to the writer and is perhaps still to be rediscovered.

Dryopteris johnstoni Maxon, sp. nov.

Fronds few, 80 to 90 cm. long, borne closely from a slender creeping woody rhizome 5 to 7 mm. thick bearing a few stout cordlike roots about 1 mm. in diameter; stipes 55 to 60 cm. long, in color dull yellowish, somewhat polished beneath a minute inconspicuous stellate pubescence, quadrangular and deeply sulcate in drying, bearing at the base a few yellowish brown, ovate or oblong-ovate scales which are noticeably stellate-pubescent; lamina glabrate, broadly deltoid, 27.5 to 29 cm. long, 20 to 24 cm. broad, 10 to 12-jugate, decreasing rather abruptly toward the apex into a narrow elongate terminal cauda 9 to 11 cm. long, deeply pinnatifid below, the apex entire; rachis relatively slight, subflexuose; pinnæ opposite or very nearly so, subcoriaceous, sessile, linear-lanceolate, caudate, the midvein elevated, especially below, with a few short minute simple hairs, veins apparent; the lowermost pinnæ 11 to 14 cm. long, 1.5 to 2.2 cm. broad, strongly deflexed, greatly reduced at the base (particularly on the lower side), broadest in the middle, uniformly lobed one-half the distance to the rachis or slightly more, the apex long-attenuate, entire, the lobes close, about 20 pairs, slightly oblique, subfalcate, rounded, those of the lower side largest (4.5 mm. broad), with 9 or 10 pairs of simple veinlets of which commonly only the two lowermost pairs extend to the sinus; succeeding pinnæ similar, differing mainly in the smaller size, shallower lobes and less reduced bases of the pinnæ, the middle and upper pinnæ being broadest at the base and decidedly falcate toward the extremity; sori of the larger (inferior) lobes about 9 pairs, relatively large, medial or nearly so; indusia firm, reddish, eventually deciduous, bearing numerous simple whitish hairs mostly at the margin.

Type in the U. S. National Herbarium, no. 532013; collected at an altitude of 450 meters on the Juan Griego trail, Island of Margarita, Venezuela, July 22, 1903, by J. R. Johnston (no. 192).

Known also from Trinidad, as shown by a specimen from the Jenman herbarium (U. S. National Herbarium, no. 428910), and a second sheet representing Fendler's no. 54 (U. S. National Herbarium, no. 50241), the latter bearing the following note attributed to D. C. Eaton: "Perhaps the *Nephrodium deflexum* J. Smith, referred to in [Hooker and Baker's] Syn. Fil. p. 292." The reference is to a note by Mr. Baker, under *Nephrodium refractum* Hook., as follows: "A Fern gathered in Trinidad by Aldridge, *N. deflexum*, J. Sm. MSS., has similarly deflected pinnæ, but they are narrower, and the lobes reach halfway down to the midrib." This description, if it may be called such, applies to the plant in hand; but Smith's name is invalidated by *Nephrodium deflexum* Presl, 1825.

The relationship of *D. johnstoni* is not with *D. refracta* (Fisch. & Meyer) Kuntze, which, as represented by several specimens in the National Herbarium, is of the section Cyclosorus. In gross characters it may be compared rather with *D. falciculata* (Raddi) Kuntze, from Brazil, the West Indian *D. pyramidata* (Fée) Maxon, and the British Guianan *D. latiuscula* Maxon. *D. falciculata* is a plant with delicate herbaceous ovate fronds, very deeply cut noncaudate glandular pinnæ, spaced segments, etc. *D. pyramidata and D. latiuscula* differ in their broader scarcely caudate pinnæ, noncaudate apex and marked pubescence, and in having the lower pinnæ not deflected.

Dryopteris latiuscula Maxon, sp. nov.

Aspidium (*Nephrodium*) *wardianum* Jenman, in herb. Not *Aspidium wardii* Kuhn, 1879=*Nephrodium wardii* Baker, 1874=*Dryopteris wardii* Kuntze, 1891.

Rhizome lacking; stipes 35 cm. long, light brownish, stout, deeply and irregularly sulcate, with a thick scurfy covering of minute whitish stellate hairs below, in the upper parts and on the rachis mixed with longer simple hairs, these at length predominating; lamina triangular-deltoid, 40 cm. long, 37 cm. broad, about 15 to 17-jugate, decreasing regularly at the apex; pinnæ straight or nearly so, opposite throughout, short-stalked (1 mm.), lanceolate, attenuate, the midvein stout, conspicuously elevated, covered with erect long and short simple hairs, these extending also to the veins and veinlets; lowermost pinnæ 13.5 cm. long, 2.8 cm. wide, borne at an angle of 90°, by the reduction of the two or three lowermost pairs of segments nearly ligulate at the base (8 mm. wide), increasing abruptly to the full width (2.8 cm.), in the remainder of the basal half lobed about one-half the distance to the midrib, the lobes gradually much shallower toward the entire attenuate apex; lobes approximate, oblique, slightly falcate, rounded-truncate, those of the superior and inferior sides about equal, the largest 6 mm. broad, with about 9 or 10 pairs of simple veinlets, the lowermost two (or three) pairs running to the narrow sinus (or the first posterior veinlet sometimes only short-excurrent): succeeding pinnæ gradually smaller, of the same general form, gradually less reduced at the base, the sixth pair of pinnæ with only the first pair of segments reduced, upper pinnæ with base as broad as the middle, ultimate pinnæ greatly reduced (1.5 to 2 cm. long), finally adnate, decreasing regularly into a short entire apex; sori of the largest segments 9 or 10 pairs, large, medial, the indusium light brown, with numerous long simple white hairs.

Type in the U. S. National Herbarium, no. 428925; from the Jenman herbarium, marked in Jenman's hand as from the "Barima River, British Guiana." A second sheet has identical data.

D. latiuscula is of the section Eudryopteris and closely related to *D. pyramidata;* to be distinguished by its stouter vascular parts, opposite and less deeply lobed pinnæ and especially by the greatly reduced basal segments of most of the pinnæ, even the upper pinnæ never broader at the base than at the middle. It is less nearly allied to *D. johnstoni.*

Elaphoglossum palmeri Underw. & Maxon, sp. nov.

Mature plants 22 to 45 cm. high, with narrow fronds covered on both sides with more or less scattered irregularly stellate scales; rootstock slender, creeping, densely covered with copious dark-brown shining prickly-ciliate linear-lanceolate scales, these continuing a short distance up the slender stipe, there mingled with whitish or rusty long-ciliate scales; sterile fronds with stipes 5 to 18 cm. long, lamina 20 to 30 cm. long, very narrowly elliptic or oblanceolate, usually widest (6 to 18 mm.) one-third the distance below the apex, gradually long-tapering below, tapering more rapidly toward the apex, both surfaces covered (often densely so when young) with rather small whitish or slightly brownish, ciliate or irregularly stellate scales, those of the midrib beneath and on the margins with a broader body; sporophyls similar in shape to the sterile fronds but shorter and with relatively longer stipes, covered more or less closely with irregularly stellate scales above, fibrillose with ciliate scales on the midrib beneath; veins distinct, oblique, mostly once-forked (usually near the base), slightly thickened toward the end and scarcely reaching the margin thus forming a condition between §Stenoneura and §Condyloneura but nearly approximating the former.

Type in the U. S. National Herbarium, no. 372375; collected near El Guama, Province of Pinar del Rio, Cuba, on banks of an open stream in the pine mountains, March 12, 1900, by William Palmer and J. H. Riley (no. 286). Also collected by Charles Wright (no. 3957), in the year 1865, probably in the same part of the island. The type specimens are lacking in sporophyls but represent the more robust stage of the species. Wright's specimens, of which there are two sheets in the herbarium of Columbia University and one in the U. S. National Herbarium, as much smaller but fertile.[a] The species is somewhat allied to *Elaphoglossum petiolatum* (Sw.) Urban, originally described from Jamaica, from which it differs conspicuously in its oblique veins, long-tapering fronds (long-attenuate below), in its copious covering of irregularly stellate scales, and especially in the prominent bristly-ciliate scales of the rootstock. In common with *E. petiolatum* and the Mexican *E. araneosum* (D. C. Eaton) C. Chr. it shows a tendency toward an intermediate position between the two usually well-marked sections of the genus, as elaborated by Dr. Christ in his monograph.

Pellaea lozani Maxon, sp. nov.

Fronds 15 to 25 cm. long, clustered upon an ascending rhizome bearing short dark acicular scales with narrow brown borders; stipes 4 to 9 cm. long (averaging 7 or 8 cm.), light brownish green, with a few narrow scales similar to those of the rhizome; lamina 10 to 17.5 cm. long, 5.5 to 8.5 cm. broad, narrowly ovate, acuminate, simply pinnate, slightly broader at the middle than at the base; rachis like the stipe, bearing numerous narrow brownish black-tipped appressed scales; pinnæ 7 to 9 pairs, approximate or slightly imbricate (only the lowermost pair or two somewhat spaced), simple, falcate, the lowermost pair sessile and sometimes hastate, those above sessile, lanceolate, auriculate, the pronounced rounded auricle overlapping the rachis, rounded or subcordate below, the uppermost two or three pairs unequally subcordate, finally adnate and decurrent, giving rise to an elongate acuminate terminal segment once or twice sharply cleft below; largest pinnæ (middle) 4.3 cm. long, 1 cm. broad near the base (1.4 cm., including the auricle), tapering regularly and evenly to an acute apex; texture firm, chartaceous; leaf-tissue covered sparingly both above and below with short whitish glandular hairs; veins close, repeatedly forked; sori forming a narrow continuous band completely around the slightly changed margin.

Type in the U. S. National Herbarium, no. 462684; collected on wet ledges in Iguala Cañon, near Iguala, altitude 900 meters, in the State of Guerrero, Mexico, July 23, 1907, by Filemón L. Lozano, and distributed by Dr. C. G. Pringle as no. 13947. The personal name is given at the suggestion of Dr. Pringle, who writes most appreciatively of his friend and assistant, Señor Lozano.

Notwithstanding the marked dissimilarity in form, the alliance of *P. lozani* is clearly with *P. seemanni*, from which it appears to differ sufficiently in its simple pinnæ, scantier vestiture, etc.

Pellaea notabilis Maxon, sp. nov.

Plant about 45 cm. high, comprising 6 long-stipitate simply pinnate fronds. Rhizome stout, 1 cm. in diameter, creeping (6 cm.), very thickly clothed with linear long-attenuate tawny silky chaff (7 to 8 mm. long), that of the apical portion light straw-colored; stipes clustered, 22 to 25 cm. long, stout, 1.5 mm. in diameter, terete throughout, straw-colored with purplish bases, naked except for a few spreading silky hairs near the base; lamina bluish green, conspicuously lighter below, chartaceous, glabrous, 20 to 23 cm. long, 13 cm. broad, deltoid-ovate in drying, once pinnate, 6 to 8 pairs of narrow-spaced (2 to 3.5 cm. apart) pinnæ and a similar terminal segment, the rachis stout, naked, straw-colored; pinnæ opposite or subopposite, all of nearly equal size (6 to 8

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[a] Also seen in the collection of D. C. Eaton and at Kew; indicated by Eaton as probably undescribed, and at Kew placed with *E. tectum* (H. & B.) Moore, originally from Venezuela, to whose type specimen, as seen in the Willdenow herbarium at Berlin, it has no close resemblance.—L. M. UNDERWOOD, in litt.

cm. long), simple, linear, long-attenuate, straight or nearly so, gradually tapering from the unequally subcordate base (8 to 10 mm. broad), the lowermost short-stalked (2 to 3 mm.), the middle ones less so, the upper sessile, the terminal segment 7.5 cm. long, conform, sessile; costa evident throughout; veins concealed, close, 2 or 3 times dichotomously forked, extending to the thick whitish narrowly cartilaginous margin; margins broadly revolute, the sori borne in a continuous broad band from the free mucronate tip of the pinna nearly to the base on both sides.

Type in the U. S. National Herbarium, no. 572223, collected by Dr. Edward Palmer, near Victoria, altitude about 320 meters, State of Tamaulipas, Mexico, February to April, 1907 (no. 234). Only one specimen was found, this fortunately in good condition.

The long, simple, entire, spaced pinnæ will distinguish *Pellaea notabilis* at once from any known species of the group characterized by light-colored stipes and rachises.

Phymatodes prominula Maxon, sp. nov.

Rhizome extensively creeping, slender, 1.5 to 2 mm. in diameter, thickly covered with appressed ferruginous firm lanceolate scales terminating in a long seta, the margins lighter-colored with flaccid deciduous cilia; fronds essentially conform, exstipitate, coriaceous, glabrous, entire, 7 to 12 cm. long, 11 to 15 mm. broad, linear-lanceolate to oblanceolate, the apex subobtuse or acutish (rarely attenuate), the lower portion gradually attenuate to the base, thus narrowly cuneate; principal venation manifest, the costa and lateral veins elevated, the connecting and included veinlets scarcely so or immersed; in sterile fronds the costal areoles narrow, the paracostal larger and extending nearly to the margin; in the fertile fronds the costal and paracostal areoles of nearly equal size, the latter soriferous; recurrent included veinlets few, short, immersed; ultimate venation comprising a minor third row of incomplete areoles near the margin; sori solitary, medial, 18 to 23 pairs, impressed, borne at the end of a single branch or at the ends of two branches short-excurrent from the costal areole; spores light yellowish brown, muricate; paraphyses filiform, flaccid.

Type in the U. S. National Herbarium, no. 531952; collected on the San Juan trail, island of Margarita, Venezuela, altitude 500 meters, by J. R. Johnston (no. 155), July 6, 1903. Represented also by Fendler's no. 50 from Trinidad and by specimens collected by Charles Wright at Greytown, Nicaragua (without number).

This is one of the forms usually called *Polypodium salicifolium* Willd.,[a] with which species as delimited by Mettenius[b] it may be identical; but this name, though used recently by Hieronymus,[c] is not tenable, having been used by Vahl for another species in 1807. Of the several supposed synonyms associated with "*salicifolium*" as a species or as a subspecies of *lycopodioides* none appears to be available. *Polypodium surinamense* Jacq.,[d] as interpreted by Lindman,[e] differs in all essential respects, as does also *Craspedaria grandis* Fée.[f] Both of these have dimorphic fronds. *Polypodium dictyophyllum* Kunze, from Guiana, is from description clearly a distinct species, as recognized by Mettenius.[b] *P. rosmarinifolium* Kunth is an allied Ecuadorean plant whose characters have recently been pointed out by Hieronymus.[c]

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[a] Sp. Pl. **5**: 149. 1810.

[b] Abhand. Senck. Nat. Gesell. **2**: 96. 1856.

[c] Engler's Bot. Jahrb. **34**: 536. 1905.

[d] Coll. Bot. **3**: 285, *pl. 21. f. 4.* 1789.

[e] Ark. Bot. **1**: 247. 1903.

[f] Crypt. Vasc. Brés. **1**: 119 *pl. 37. f. 2.* 1869.

The alliance of *P. prominula* in outline and venation is rather with the well-known *P. lycopodioides*, from which it differs not only in its more conform fronds but also in its raised venation, slighter rhizome and more translucent tissue.

Polypodium dissimulans Maxon, sp. nov.

A very delicate pendent plant with numerous flaccid linear fronds; rhizome erect, minute, slender, 1 to 1.5 mm. in diameter, bearing a few relatively large bright brown lanceolate scales, with dark cell walls; fronds 15 to 20 cm. long, 9 to 12 mm. broad, scarcely stipitate, greatly reduced below, the rachis filiform, dark brown or blackish, bearing 45 to 60 pairs of distant narrow alternate pinnæ, decreasing gradually toward the apex or sometimes abruptly to a narrow terminal caudate segment 2 cm. long, 2 mm. broad at the base and there coarsely lobed; pinnæ separated once or twice their width, adnate, smooth, membranous, translucent, the lowermost minute, decurrent, distant less than 1 cm. from the rhizome, those immediately above gradually larger and with simple midveins; characteristic pinnæ 6 mm. long, 1.75 mm. broad above the base, strongly decurrent, lanceolate, straight or slightly recurved, borne obliquely (usually at an angle of about 45°), margins with a few shallow dentate serrations, apex somewhat produced, subentire, obtuse, midveins dark, flexuose, with about 4 or 5 pairs of oblique alternate veins extending half way to the margin and corresponding to the oblique marginal teeth; sori large, slightly impressed, confluent with age, terminal upon the veins.

Type in the herbarium of Capt. John Donnell Smith; collected from tree trunks near Coban, Alta Verapaz, Guatemala, at an altitude of 1,300 meters, February, 1886, by H. von Türckheim. The collection including this was distributed by Captain Smith as no. 884, *Polypodium jubaeforme* Kaulf. A specimen of this number in the U. S. National Herbarium is less complete.

The present species is readily distinguished from *P. jubaeforme* by its exceedingly delicate texture, very slender vascular parts, almost superficial sori, and toothed pinnæ, the last a character noted by Captain Smith. The relationship is rather with the British Guianan *P. melanotrichum* Baker[a] and the closely allied *P. suprasculptum* Christ,[b] the latter described recently from Costa Rica. From these it differs notably in its very narrow fronds and few shallow blunt teeth.

Stenochlaena latiuscula Maxon, sp. nov.

Rootstock wide-creeping, flattened, about 7 mm. broad, 3 to 4 mm. thick, naked or nearly so, bearing a few naked dark yellowish brown lanceolate scales at the base of the stipe and extending up the stipe a short distance (3 to 4 cm.). Sterile frond dark green, about 70 cm. long; stipe 20 cm.; lamina exactly lanceolate, at the base truncate, 50 cm. long, 25 cm. broad at the middle and at the base, about 17-jugate, the pinnæ 12.5 cm. long by 1.6 to 1.8 cm. broad, simple, linear-lanceolate, subopposite, spaced about their width, borne at 90° to the stout terete very narrowly alate rachis, short-petiolate, subequally and rather obtusely cuneate, tapering gradually from near the middle to an evenly long-attentuate straight or slightly falcate apex, the margins evenly crenulate-revolute in drying; veins conspicuous, simple or more commonly once-forked at or near the base, diverging from the costa at an angle of about 70°; intercostal spaces about 8 to 1 cm. Fertile fronds similar but smaller, about 13-jugate, the rachis fibrillose-chaffy; pinnæ linear, 10 to 11 cm. long.

---

[a] Timehri II. 5: 216. 1886; Trans. Linn. Soc. II. Bot. 2: 292. 1887.

[b] Bull. Herb. Boiss. II. 5: 3. 1905.

7 to 8 mm. broad near the base, obtusely cuneate, stalked (2 to 3 mm.), long-attenuate, in drying folded along the midrib.

Type in the U. S. National Herbarium, no. 474000, collected at Juan Viñas, valley of the Reventazón, Costa Rica, altitude 1,000 meters, by O. F. Cook and C. B. Doyle (no. 208), April 22, 1903. Less perfect specimens are those collected by Wercklé and by Cooper, both without exact locality in Costa Rica. Known also from Guatemala upon a specimen collected by von Türckheim at Pansamalá, Alta Verapaz, altitude 1,200 meters, February, 1887 (*J. D. S. 1129*), in the herbarium of Capt. John Donnell Smith.

The present species is probably most closely allied to the true *S. sorbifolia*[a] which appears to be strictly a West Indian species. It differs in its darker almost reddish chaff, in having the frond not reduced below or only very slightly so, in the longer and relatively narrower pinnæ, these tapering and long-attenuate from near the middle and not from the outer third as in *S. sorbifolia.*

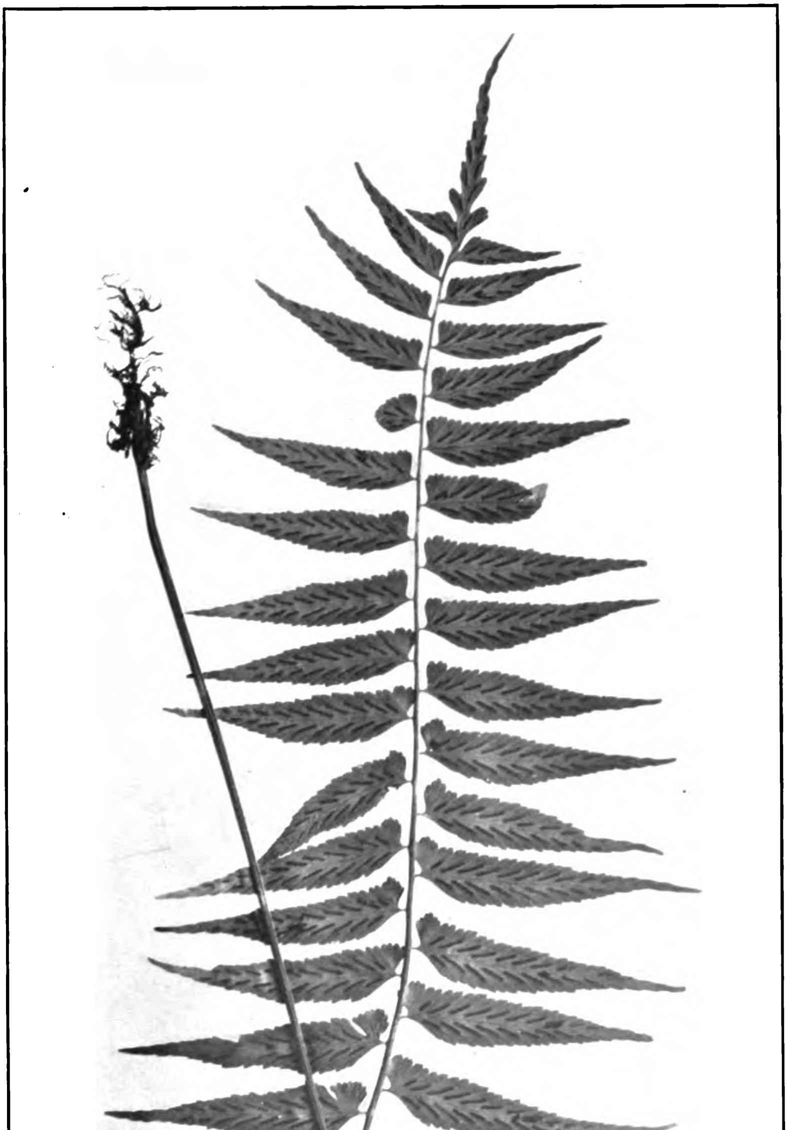
---

[a] As delimited by Professor Underwood, Bull. Torr. Club 33: 591–605. 1907.

PLATE LV.

PLATE LV.

Photograph of specimen of *Asplenium salicifolium* L., U. S. National Herbarium no. 523061, collected at Monte Verde, Province of Oriente, Cuba, altitude about 575 meters, by Wm. R. Maxon, no. 4306. About two-fifths natural size.



ASPLENIUM SALICIFOLIUM L.

PLATE LVI.

PLATE LVI.

Fig. 1. *Diplazium delitescens* Maxon.

One of the second pair of pinnæ from the type, U. S. National Herbarium no. 403261. *Pollard & Palmer* 348, from the vicinity of San Luis, Province of Oriente, Cuba.

Fig. 2. *Asplenium integerrimum* Spreng.

One of the second pair of pinnæ of a frond collected on forested slopes of the Finca Las Gracias, Yateras, Province of Oriente, Cuba, *Maxon* 4479.

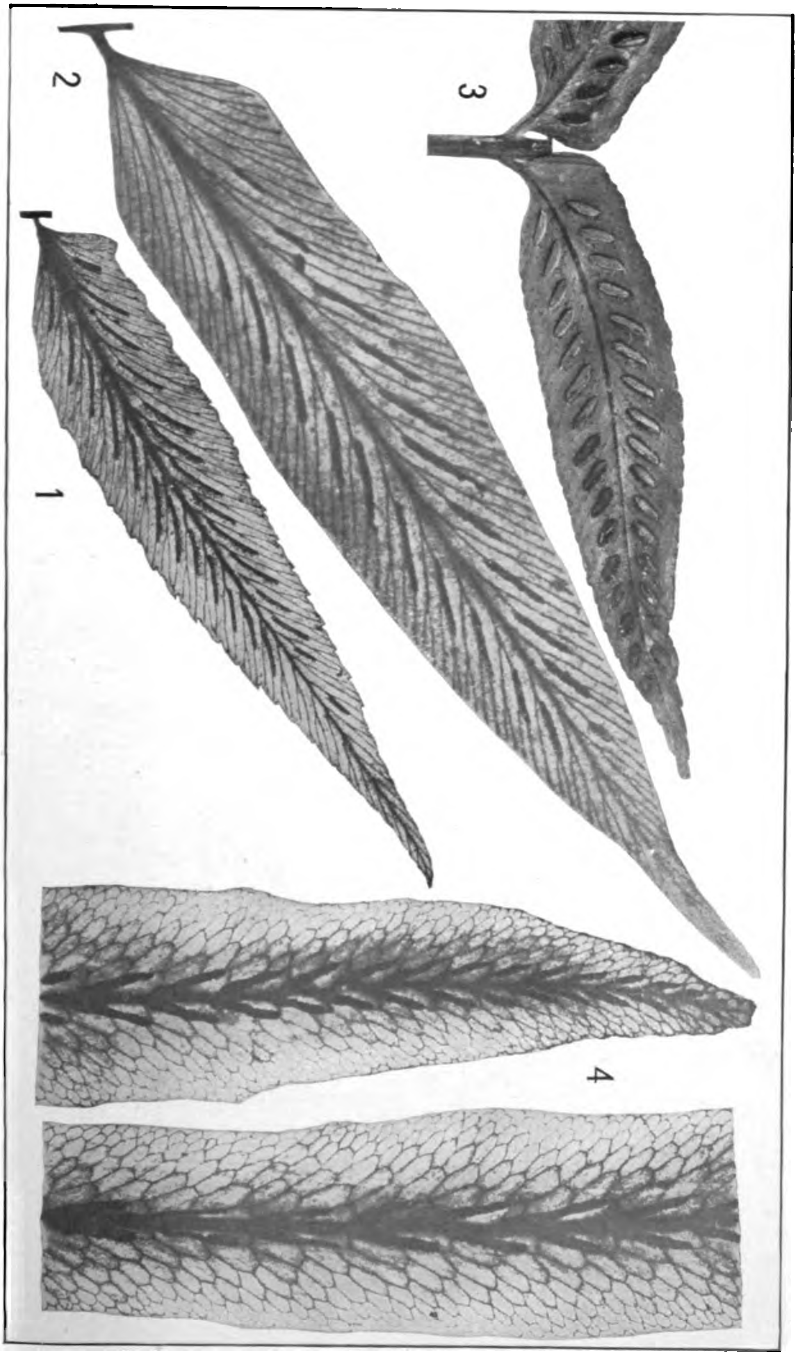
Fig. 3. *Asplenium sarcodes* Maxon.

A characteristic middle pinna from the type, U. S. National Herbarium no. 523133, collected on the farallones of La Perla, Yateras, Province of Oriente, Cuba, *Maxon* 4390.

Fig. 4. *Holodictyum finckii* (Baker) Maxon.

Apical and adjoining portion of a frond of Dr. Edw. Palmer's no. 336, collected near Gómez Farías, State of Tamaulipas, Mexico.

Figs. 1, 2, and 4 are from nature prints. Fig. 3 is from a photograph. All are at natural size.



DIPLAZIUM DELITESCENS MAXON, ASPLENIUM INTEGERRIMUM SPRENG., ASPLENIUM SARCODES MAXON AND HOLODICTYUM FINCKII (BAKER) MAXON.

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